THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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INDUSTRIAL PREPARATION.

Two months ago, in reviewing some of the measures which had been adopted by certain important British electrical manufacturers to prepare for the reconstruction period, we stated our conviction that it was to industry itself, even more than to statesmen and social reformers, that the nation must look for levelling out some of the rough places of the post-war period. The necessity for better organisation of electrical and engineering industries has been recognised for several years, and, compared with pre-war days, very substantial efforts and progress have been made. Nobody who has watched from the inner circle the course of practical operations would dream of suggesting that to-day, either in organisation or in productive efficiency, we stand where we did. Progress may have been slow at particular periods during the past four years, and to some it may have appeared slower than it actually was, because much has had to be concealed from their view by the necessary supervision imposed by D.O.R.A. The development of new manufactures to avoid renewed importation, the extension of old and the erection of new factories for specialised production, though not as much can be said about them as would be possible under normal conditions, are pretty well known among engineers, though even these occasionally learn of some new advance achieved on a large scale somewhere or other in these islands which it is not policy to reveal to certain watchful eyes. Organisation schemes involving delicate negotiations and leading to transactions of considerable proportions between manufacturing leaders, are of necessity somewhat more protracted, and do not come to maturity with the same order and expedition with which one proceeds with a new manufacturing operation, or builds a new power house or factory. They may be begun and suspended, and then promoted again in some new form or on different lines, and much may be proceeding *sub rosa*. All such matters naturally give rise to rumour, but it is only when schemes reach the stage of actual maturity or achievement that they can be safely considered as contributions to the work of practical reorganisation or extension in preparation for reconstruction of industry after the war.

Mr. Hughes, the Prime Minister of Australia, in referring to the subject of organisation in readiness for Peace, has been covering very much the same ground as he did a couple of years ago. No doubt there is great need of platform appeal to the nation as a whole in respect of such matters, though possibly such appeals do not carry great weight with the people under the prevailing war conditions. Mr. Hughes, of course, approaches the subject broadly, calling for a declaration of national policy which the Government, with its desire to maintain the party truce while the guns are still roaring, has not, so far, seen fit to make. He is not concerned with particular industries, and with so many subjects to command his attention, he is probably unable to follow in detail what has been taking place in any special department. There is a tone of reluctance about his remark:—"I am glad to believe that *something* is being done by *some* people in *certain* industries." The events in the electrical and engineering industries to which we referred in our article of a couple of months ago represent a substantial contribution toward reconstructional improvement, and probably they are by no means the end of what these industries will do. There are still some substantial electrical businesses of reputation which have not joined in the movement. When rumour plays with the names of some of them it may be that there is a desire to feel their pulse, or it may be only

the work of brokers holding a few shares. Perhaps, even, they have no disposition to "couple up" too closely. There can be a strong business without immense capital. We have seen that practically exemplified where specialised manufacturing limited in class has been accompanied by modern methods, effective personal management, and sound finance. There will be room for many prosperous businesses run on these lines in the electrical and engineering industries of the future.

We printed in our last issue a fairly full report of the important speech that was delivered at the annual meeting of the General Electric Co., Ltd. To those who wish British electrical manufacturing to be strong and on a larger scale in readiness for really effective trading operations throughout the greater part of the world, the programme of Mr. Hirst cannot fail to be inspiring. There is a strength in millions of capital that cannot be possessed by those with hundreds of thousands (if they spread their efforts over too wide a variety of manufactures) when we come up against the Teutonic many-millions concerns which have had things too much their own way in the past. An examination of Mr. Hirst's programme shows that it is the development of a plan laid by him years ago. In some respects the completion of the entire scheme in all of its parts was interfered with by the war, and businesses have been purchased instead of being initiated under G.E.C. auspices. In other respects, which need no enumeration to those who have studied the speech, the state of war has continued long enough to facilitate or to render possible the perfecting of parts of the plan which would have been far more difficult to carry out under the normal conditions obtaining in pre-war days.

The Government has before it the advice of expert authorities concerning the measures that are essential if our great industries are to be safeguarded against outside action in Peace time, enabling them to be profitably conducted for the good of the Empire and for the benefit of the millions for whom well-paid employment will be so necessary. There is still no actual certainty how far the terms of Peace will affect economic relations between our Allies and ourselves. Mr. Bonar Law's answer to a Parliamentary question on Tuesday indicates the Government's difficulty:—"It is not a question of how much their (the Dominions') minds are made up; you must examine the facts." There is likewise uncertainty regarding what will be the issues of a great election when it comes or the political programmes on which it may be fought. Unfortunately, when there is such a variety of problems looming on the horizon for that coming electoral contest, there is little hope of a clear-cut issue on one great question. But we believe that the heart of the people is sound in its opposition to wholesale dumping and penetration by the enemy, and it is the confidence of manufacturers that the Government and the industrial workers will see where the real interests of the nation lie, that induces our industrial authorities and companies to make these far-reaching developments in their organisations. We cannot but believe that many of the changes which are now taking place will be justified in years to come. The entire attitude of Labour toward Industry, however, is unquestionably a matter which gives occasion for serious thought and even of anxiety; but whatever the future may have in store in this connection, it is our bounden duty to-day to do the utmost that lies within our power to rearrange our industrial businesses, even under war conditions, so that they may be in a position to yield the maximum amount of employment with good wages and satisfactory conditions for the worker, and a financial prosperity which shall render Capital secure and the national revenues sufficient.

British Engineering in Spain.

FOLLOWING up our several recent references to the need for British manufacturers to make special efforts to secure a hold upon the Spanish market for engineering and electrical equipments and apparatus, we may direct our commercial readers' attention to an interesting pamphlet bearing the title "Spain for British Engineers," which was issued some little time ago by the British Engineers' Association, 32, Victoria Street, S.W. It is written by a British engineer who was in Spain for some years handling British machinery. He makes a number of suggestions, based upon his practical experience gained in touch with the principal buyers, both official and commercial. Our failure to foster electrical and engineering trade in that country need not be further enlarged upon at this date. That our neglect enabled Germany to exploit the possibilities of the situation is, we suppose, commonly recognised. The high reputation of British machinery in comparison with that of our foreign competitors should have secured far better results for us, and it would have done so had we followed up the appreciation of the merits of our manufactures by maintaining an appropriate contact with buyers of such articles. The writer of this pamphlet advocates the adoption of new methods and the establishment of an intimate contact with the people. Suitable selling agencies should be established in the principal cities "where engineering products are in constant demand, fed by sub-agencies in the provinces, so as to cover in course of time the whole country." In the investigation of the engineering features of the situation it is practically futile to send any but practical engineers, and the advantage of possessing a knowledge of Spanish needs no emphasis, though French may be of assistance in the absence of such knowledge. The pamphlet before us contains some useful hints on sale conditions and warning respecting official contracts—the latter is worthy of study in relation to municipal orders, a department of activity where credit is "notoriously bad." We commend the publication, which we believe is one of a series, to the notice of any electrical engineering firms who have not already studied it.

Statutory Charges.

THE Bill providing facilities for revising the statutory charges for public services, which is now before Parliament, has been received with mixed feelings by those responsible for the conduct of such undertakings. We briefly outlined its provisions in our last issue (page 35); it will be seen that in the case of companies, its effect is practically to reduce the dividends to half their average value before the war, and to keep them at that value during the war and for a period of two years longer. The intention of the measure is said to be to divide the burden equitably between the suppliers and consumers.

When we compare this procedure with that followed by the Government in the case of the railways we cannot help wondering where the "equity" comes in. Railway passengers have to pay 50 per cent. more for the same service, while the shareholders are guaranteed substantially the same dividends as before the war; tramway passengers will also pay increased fares, but in this case the shareholders' incomes from their investments, not too large at the best of times, will be cut down by 50 per cent.—which is not by any means equivalent to an increase of 50 per cent. in the charges, either in ratio or in effect. Moreover, the incomes of the passengers in many cases—perhaps most cases—have increased during the war by at least 50 per cent., so that they will be relatively no worse off through an increase of fares, whereas the tramway shareholders have to meet the increased cost of living with reduced incomes.

On the other hand, municipal tramway undertakings will be allowed to increase their fares "sufficiently to prevent loss" (but not more than 50 per cent.), which means that they will be able to pay the normal rate of interest to the mortgagees or loan-holders who provided the capital. Where is the equity in this case?

The same considerations apply in the case of electricity supply undertakings, and it should not be forgotten that privately-owned electricity and tramway undertakings are usually liable to purchase by local authorities, so that they have only a limited period in which to make good the deficiencies imposed upon them by the Bill. When we look around and see the prosperity enjoyed by so many of our industries in private hands, while these great public services are thus to be restricted to half their modest normal profits, we feel that "equity" appears to be a missing quantity in this connection.

THE EDUCATION AND TRAINING OF ENGINEERING APPRENTICES.

By P. H. S. KEMPTON, A.R.C.Sc., B.Sc.

ONE of the *good* things that the war has given us is the awakening of the nation to the need of education, especially scientific and technical education. The general trend of public opinion, the finding of the Lewis Committee, and finally the new Education Bill, are all indications that this awakening is to be a real one and not a stretch and a yawn, followed by relapse into a profounder lethargy. The chief sections of the new Education Bill deal with the raising of the school-leaving age and compulsory attendance at continuation classes up to the age of eighteen; both are reforms long overdue, and the latter bids fair to revolutionise technical education in this country. Fortunately the engineering profession has everything to gain and nothing to lose from any proposals that would tend to raise the standard of education, and schemes are already afoot which anticipate the Minister of Education's proposals. Some of these schemes have stood the test of time, and are worthy of consideration as models upon which future developments can be based; others are admittedly experimental, but nevertheless worthy of attention as providing tests of new and untried educational ideas and theories.

It is unnecessary to insist that our survival as a great industrial nation depends largely upon our engineering resources and efficiency, and that the engineering efficiency of the future is dependent upon the training of the youths of to-day. These things have been said so frequently that they have become platitudes. But it is still painfully true that we are in very little better position to tackle after-war problems now than we were two years ago.

So little is generally known concerning the training of engineers that the Board of Education recently issued a pamphlet: "Engineering Training, Circular 999. Some notes on existing facilities. Board of Education, 1917," purporting to give some information to parents and others who might be interested. And that this lack of knowledge has led to numerous square pegs being in round holes and consequent inefficiency is indisputable.

All of which indicates that it is high time for us to review our system of apprentice training with some thoroughness, and by wholesome demolition of stale and unsound practices and judicious reconstruction on well-tried lines to erect an educational structure which will prove adequate to modern and post-war needs.

In the ELECTRICAL REVIEW of December 1st, 1916 an account was given of the Admiralty method of training apprentices, which has worked with valuable results for many years in connection with H.M. dockyards. The immediate purpose of the present article is to give an account of some of the systems of apprentice training which are in operation in this and other countries, and to indicate the lines of possible development.

In this connection it is worth while noting that there appears to be an almost universal consensus of opinion that this question of apprentice training is at the very root of success in the engineering industry, a consensus of opinion that is widened by the following almost haphazard choice of quotations from recent speeches and writings on this subject:—

"In fine, it is sound economics for industries to pay the cost of the training of its own boys." Mr. Algernon E. Berriman, O.B.E., chief engineer of the Daimler Co., in a recent article in *Engineering* (February, 1918).

"Only when manufacturers are prepared to take active interest in industrial training will they be able to ensure that the type of training given to workers is the best from an industrial point of view." *British Westinghouse Gazette*, February, 1917.

"The difficulty of obtaining men with the proper training for performing the exacting work demanded by many of our modern industries has led to the institution by some of the larger concerns of special training courses for boys and young men." From the *General Electric Review*, organ of the G.E.C., U.S.A., January, 1918.

"These youths should be liberated for at least two, and if possible three, half-days a week for the purpose of their technical education. . . . Your committee are unanimous in expressing their belief that the extra expense involved in the absence of apprentices during class hours will be returned to the employers in a far higher degree in the broader mental outlook and initiative of the individual." From the report by a special committee to the N.E. Coast Institution of Engineers and Shipbuilders.

Still further evidence that these revolutionary methods of apprentice training are not the ill-advised and unconsidered whims of modern pedagogues, but that they have been very definitely stated by far-seeing engineers and educationists as far back as the seventies is shown by the following significant sentences from a letter written to the Press by Prof. John Perry in December, 1879: "It is high time that a change should be brought about in the apprenticeship system of England. . . . If we consider the great number of apprentices who are to receive instruction, we must, in spite of the well-known experiments on the Continent, come to the conclusion that the practical part can only be given to them in ordinary workshops. . . . What I advocate is the establishment of classes in the neighbourhood of workshops, where, during two hours a day, they may learn how a knowledge of natural science is applied in their particular trades. These classes ought to be day classes." And in 1889: "Every apprentice should devote at least one hour a day, five days a week, during working hours, to study at a technical school."

Every scheme of technical training of apprentices recognises the existence of three classes of apprentices:—

1. Those whose exceptional ability and "staying powers" will enable them to reach very high positions in their professions.

2. Those whose ability is something above the average, and who will become the foremen and draughtsmen of their trades.

3. Those who are unlikely to rise beyond the level of the journeyman artisan.

Therefore every such scheme must provide for the sifting and adequate training and development of these classes. The first must be given a straight road to the completion of a university course without financial anxiety; the second must receive that special training which will result in a broad outlook and an initiative such as is required of those who are in actual charge of workshops and shipyards; the third must be given as sound a training as is possible in view of their restricted abilities, special care being taken to remedy any defects in their early or fundamental instruction.

(To be continued.)

Electrical Development Campaign in the U.S.A.—The activities of the Society for Electrical Development, in its campaign for a broader and better use of electrical household helps, are striking a popular chord and showing fruitful results. We learn that last year there was a sale of more than $10,000,000 worth of washing machines, at the rate of something like 200 washers per day. About $4,000,000 worth of vacuum cleaners and over $7,000,000 worth of other electrical labour-saving appliances were also sold, which goes to show that there is a real and ever growing need for such appliances in the home. Complete details will be sent to practically every electrical concern in the country, and the Society gladly furnishes information upon request.

The progress of electrical development in this country is sadly handicapped by the lack of a similar energetic organisation; we trust that in the new era that is about to open, this deficiency will be remedied.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

THE twenty-first annual general meeting of the Tramways and Light Railways Association was held on Friday last at Caxton Hall, Westminster. Mr. R. J. HOWLEY, M.Inst.C.E., vice-chairman of the council, was in the chair, supported by Mr. James Devonshire, Coun. R. Mayne, Mr. A. L. C. Fell, Mr. S. Sellon, Mr. W. E. Hardy, Mr. E. H. Edwardes, Mr. A. L. Barber, Mr. E. Hatton, Mr. H. England, Mr. S. White, Mr. C. D. Stanley, Mr. W. Thom, Mr. Mason, and Mr. A. de Turckheim (secretary).

Sir ARTHUR STANLEY, G.B.E., M.P. (chairman of council), who had been seized with illness, sent his address, which explained that there was a net credit balance of £87 on the year's working, with a total of £608 to carry forward, of which £550 was invested in War Bonds. The feature of the year was the setting up of the Board of Trade Tramways Committee, of which their past vice-chairman, Mr. Devonshire, had been appointed chairman. A better choice could not have been made. Mr. S. Sellon and Mr. Howley had been appointed to represent the association on that Committee. This committee was urgently needed, for a great variety of questions covering the whole field of tramway work had to be dealt with. They might not have got all they wanted, but at least tramway administrators and managers now knew where to go and to whom to apply. There had been a perfect epidemic of demands for increased wages, at first local, afterwards national. Great unrest prevailed, and the Committee on Production made awards week after week till there was hopeless confusion. At last there was a demand for a national award of a 20s. bonus, and a committee was formed to represent the undertakings before the Committee on Production. Since then there had been a further demand for a 12½ per cent. increase or its equivalent. In the result an award was made on July 9th, increasing the 20s. bonus to 25s. per week, and was in full settlement of any claim with respect to the bonus of 12½ per cent. A claim for an equal bonus to women failed. They highly appreciated Mr. Howley's work at both arbitrations. So far back as 1916 steps were taken to obtain relief by pressing for powers to increase fares. Nothing was done till last April, when a House of Commons Committee was appointed. Last June the Committee reported, not in favour of a short measure which would have allowed the situation to be dealt with quickly, enabling some of the hard-hit undertakings to take advantage of the summer season, but submitting a controversial combined Bill dealing with gas, water, electricity and tramways, the provisions of which were inapplicable to tramways generally. This was a severe disappointment. As to Industrial Councils, a draft scheme for setting up a National Council for Tramways was all but completed, and any attempt to bring employers and employés into closer co-operation for their mutual benefit should be encouraged, as likely to lead to a better understanding, harmonious working, and improved results. The council had also dealt with such matters as decimal coinage in its application to tramways, standardisation of overhead line material, national service, deferred repairs and statutory depreciation allowances, women drivers, steel tires, &c. The next matter that the committee would devote attention to was the supply of materials after the war, and the Board of Trade Report on Electric Power Supply, tramway generating stations, and many other kindred matters.

After the adoption of the report and accounts, some discussion took place, at the instance of Mr. E. Hatton and Coun. R. Mayne, of Newcastle, as to the composition of the council as representing the municipal and company sides of the tramway industry. Six members retired, including two municipal men, leaving only three out of eighteen. The council recommended the election of six company men only. Mr. A. L. C. Fell (L.C.C. Tramways), Coun. Mayne, and Mr. Harvey (Ilford) were nominated, and the six vacancies were filled by ballot by the appointment of Messrs. H. England, E. H. Edwardes, Fell, Coutts, Mayne and Baker, two additional municipal representatives being thus added to the council.

The CHAIRMAN opened a discussion on the recent national awards, and detailed the action taken by the council. He explained the effect of the award of July 9th, and said that the 5s. advance was the figure expected in view of other decisions. Tramway employés were getting very excellent remuneration as compared with other classes of workers.

Messrs. Barber, Hatton, Cox, White, Mayne, Fell, Stanley and others took part in the discussion, which was followed by a paper by Mr. E. H. EDWARDES (S. Lancs Tramways Co.) on "National Industrial Councils," in the course of which he showed how the Whitley scheme was being applied to the tramway industry. He emphasised the far-reaching nature of the schemes now in the process of completion, and said that the employés would have to be divided so far as tramways were concerned into two classes—municipal and company.

Mr. DEVONSHIRE reminded the members of what was happening with regard to the efforts of the Ministry of Labour to assist and train disabled soldiers and sailors on their discharge. Large numbers of men, not all physically fit by any means, were coming into the market, and with them sympathy must lie. He had to represent the council at the Ministry of Labour in connection with the employment of disabled sailors and soldiers in electric light and power stations. On the one side were five employers' associations, and on the other five trade unions. They had started in a small way with sub-station switchboard work, and the ten bodies he had indicated had under the constitution power to nominate their own chairman. With due modesty he might mention that the trade unions had proposed him as chairman and he had occupied the position ever since. They were now called the National Advisory Committee for the whole of Great Britain and Ireland in connection with the employment of disabled sailors and soldiers for electrical work. He thought so far as their industry was concerned a good foundation had been laid for the establishment of industrial councils.

Mr. A. L. BARBER opened a discussion on "Increased Fares," and traced the efforts to obtain statutory powers to enable tramway undertakers to recoup themselves for increased cost of running, maintenance, &c. He detailed the provisions of the new Board of Trade Bill, and said that the first amendment sought by the Association referred only to company-owned undertakings, and its effect was to suggest that the Board of Trade should have power to modify the fares and charges to such an extent as would enable companies to earn 5 per cent. on the capital properly expended on the undertaking. This would practically put companies on the same footing as municipalities. The second amendment was to ask for the proviso that any modification of fares should not be less than a halfpenny. It was impossible to say what would be the result of their efforts, but members of the association could be satisfied that everything possible was being done on their behalf.

Considerable discussion ensued as to the financial effects of the amendments that were sought, and in reply, Mr. Barber pointed out, to remove misapprehension, that the fixed percentage asked for was upon capital expended.

Mr. W. E. HARDY next opened a discussion on the Coal Restriction Order, pointing out how greatly

industrial consumers of electric power were affected by the new regulations. Tramways appeared to have been singled out in the call made for economy, perhaps because they were easily accessible to Government departments. With the advent of the new order for rationing coal for householders, the question of the 15 per cent. reduction of consumption of electricity by ordinary consumers was in reality wiped out, and even the favoured North came into the scheme, so that he would not be surprised to learn that considerable modifications might be made in the Coal Restriction Order as applied to tramways. He referred to the different interpretations of the order, and said that a 15 per cent. reduction in coal consumption meant considerably more than a 15 per cent. reduction in service, because the standing losses in a power station would be practically unaffected. Therefore the tramways with their own power stations were harder hit than those which purchased energy. He referred to the use of coke breeze, and particularly invited the opinions of generating station managers in the matter of burning this fuel.

Considerable discussion followed, in which the argument was in favour of the substitute for coal, and the proceedings closed with the customary votes of thanks.

TRADE UNIONISM—PAST AND FUTURE.

(Communicated.)

Many are the discussions on trade unionism in its different aspects to-day, and many are the criticisms levelled at the various unions and branches of unions, on their action or inaction, their programme or their status, and particularly is this so in the electrical industry, but throughout all these discussions and criticisms there appears a general impression that some sort of trade unionism is not only desirable, but absolutely essential to modern working conditions. Yet no one union so far seems to satisfy the requirements of all its members, and others who would be members but for the fact that the union, as we have it to-day, is so obviously imperfect, and that is why electrical workers are not all members of one union, and why jealousy, bad feeling, and suspicion, have existed between two such unions as the E.T.U. and the E.P.E.A.

Nor can there be any improvement in this direction until the general principles underlying trade unionism have undergone a great change, and have been explicitly defined. The common formulæ of the present trade unionism are not palatable to all the workers, especially in the electrical industry, and as a result the higher or technical grades of workers have not been attracted to the unions, yet even those who on political grounds, or because of visions of "status" and the loss thereof, have been most antagonistic to the unions in their recognised and usual form, are beginning to feel that the organisation of labour is a vital necessity not only to the workman himself, but to the nation as a whole. Nor can this be wondered at when we consider that many technical men to-day find a difficulty in obtaining more than about £150 per annum, or even less; but they are not prepared to sacrifice their most cherished principles without a struggle, and so their only hope lies in the formation of a new union whose aims and objects, although not entirely dissimilar from the aims and objects of the everyday union, will fit in more with their views on the conduct of theirs and the nation's affairs.

Is it, therefore, possible to form a new union which will be satisfactory to all classes of workmen, and which will efficiently protect both the workman and his industry? To answer the question it would be necessary to go into the whole history of trade unionism from its birth. To do this thoroughly is obviously impracticable in a short article of this description.

But let us have no doubt, no compromise on one point. The miserable portions of our population came in to serve a system, the system underlying our principles of trade, the system of cheapness. They never had a chance to be anything but miserable, and as time went on they conceived the idea of organising in the hope of bettering their conditions. In fact, trade unionism sprang up as a revolt against the system, and was a protective movement for a class of producers, or a reaction against the traditions of trade. But in the first place they made one grave mistake, and it has hindered their progress ever since. They felt that as producers their interests had been little cared for by their employers, and they, in their turn, thought little of the interests of the country. They failed to realise that if the individuals of a nation are to be successful, then that nation as a whole must also be successful. Their only thought, however, was of protecting themselves, and they did nothing to foster production and to maintain efficiency.

It is true that trade unionism did to some extent encourage efficiency, and many of the best workers were enlisted in its cause, but as a whole they did not realise that it was the inferior workman who encouraged cheapness, and that he was the agent of the employer who wished to depress wages.

To the working man the trade unions stand as his last hope of maintaining his position in the social system. It is therefore a good sign that the country generally is beginning to appreciate the importance of production on the large scale and general efficiency in production. No longer do workmen complain of labour-saving machinery, for they have learnt that the machines increase their output and that increased output means better wages. All our attention is now concentrated on increasing the national output, and since the old form of trade unionism did nothing to encourage output, some new form of unionism is clearly desirable.

This new trade unionism cannot long be delayed, although there is no direct evidence that it is in the making. A new national policy is freely talked of, and there is no reason why the new trade unionism should not form an important feature of the national policy, but whenever, and however, it is formed, it must be based on the recognition of the producing character of the people as a whole.

The union which merely forces wages up by continual agitation is a failure because we have learned by now that so surely as wages increase, so surely does the cost of living go up proportionately; but the union whose principles are based on the recognition of producing character will be favourable alike to all classes of workmen and will bring them more in touch with the employers. It will discourage unorganised and casual labour, as well as inefficiency, and it will fight the bad employer. Moreover, it will become compulsory, and although it will regulate wages, conditions of employment, education of the workers, and the standard of work turned out, it will not interfere with management except perhaps to help to control competition.

The present is a splendid opportunity for this great reform, which is the best and only revolution we need in this country. We require a strong leader, and surely in the electrical industry such a man can be found, but he will have a hard office to fill, for in many the class prejudices and the suspicion of employers are very deeply ingrained.

If only such a man can be found, a man of honourable character, who will have the respect and confidence of employers and workers alike, then we can feel justly optimistic. Yet our chief hope can surely be found in that great British Army, which we all hope to see soon returning to civil and industrial life, for its members have learned their lesson by bitter experience.

D

AUTOMATIC POWER FACTOR REGULATION.

In any A.C. power installation which includes induction motors subject to fluctuating loads the inevitable question of power factor has to be contended with, particularly so to-day when industrial power loads are developing rapidly in number and size, and it is becoming increasingly difficult for supply undertakings with their existing plants to meet the demands of their customers. Moreover, where the charge for power is on a K.V.A. basis, it is obviously to the consumer's advantage to reduce his power bill by regulating the power factor of his system and keeping it as near unity as possible, and, if this regulation can be carried out *automatically* without complication or other operating disadvantages, the additional cost of the automatic gear becomes negligible in comparison with the direct saving of money it brings about.

The three methods by means of which the power factor of an A.C. installation can be improved may be broadly classified as follows:—

1. The application of phase advancers of the commutator type to individual induction motors.
2. The use of static condensers.
3. The use of over-excited synchronous motors and rotary converters.

Each of these methods has its advantages and disadvantages, and has been described and discussed in the technical Press from time to time. The third method, however—the use of over-excited synchronous machinery—is the only one which lends itself readily to automatic control.

An interesting example of this method of power-factor regulation is afforded by a plant recently installed at the Ledston Luck Colliery of the Micklefield Coal & Lime Co., by the advice and to the specification of Mr. W. B. Woodhouse.

The overall power factor of the existing electrical system was about 0.6 lagging, and to correct this a synchronous motor was installed to drive the ventilating fan for the pit, this being large enough at the same time to furnish sufficient current to raise the power factor of the whole system to a value approaching unity. The equipment included a Brown-Boveri automatic regulator specially adapted for use with this motor in such a way that the field excitation of the latter could be automatically varied to the extent necessary to compensate the whole of the lagging current of the installation.

The motor in question was supplied by Messrs. Mather and Platt, and is rated at 1,000 K.V.A., 2,000 volts, 50 cycles; as it is only requred to give an output of 360 B.H.P. continuously

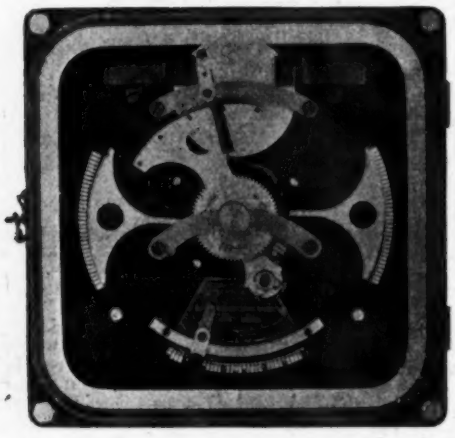

Fig. 1.—Automatic Power-Factor Regulator.

for the fan, the surplus K.V.A. capacity is available for phase compensation. The automatic power-factor regulator (shown in fig. 1) was supplied by Messrs. Brown, Boveri & Co., Ltd., London; it controls the excitation of the motor on the same principle as that of the well-known pressure regulator made by this firm. In this case, however, the series transformer is inserted in the bus-bars, so that the regulator follows every change of power factor on the system, and correspondingly varies the excitation of the fan motor—and hence the K.V.A. output of the latter—in such a manner that the power factor of the whole installation is automatically maintained practically at unity independently of variations in the load and power factor of the individual motors about the pit.

This plant has given very satisfactory results during a long period of commercial operation, and is worthy of special notice by those power suppliers who are troubled with the technical difficulties which a low power factor invariably brings about, and also by those power consumers who have to pay for their power on a K.V.A. basis. In either case the judicious installation of suitably rated synchronous motors, automatically over-excited to compensate the phase displacement of the local system as above described, will invariably bring about advantages and savings that will soon repay the extra cost of the special gear.

Fig. 2 is a general diagram of connections for automatic power-factor regulation. It is important to know that the

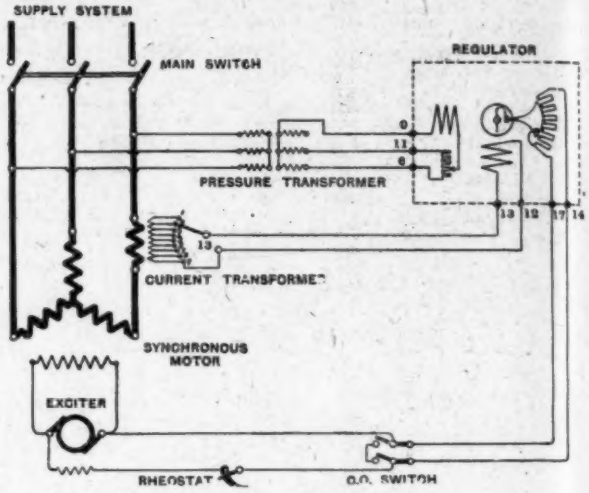

Fig. 2.—Diagram of Connections.

principle involved is not limited to the case of isolated synchronous motors, but is applicable to all synchronous machinery, and in particular to generating stations as a whole. For instance, in the case of a number of power stations operating in parallel, all the generators installed in one or more of them can be provided with equipments for the automatic regulation of the power factor, the pressure regulation of the system as a whole being taken care of by one or more of the other stations feeding the same system. In this way the pressure regulation of large interconnected systems becomes simplified and improved, while the automatic control of the power factor of the system is of great advantage.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Indicator to Call a Deaf Clerk.

A large firm in Edinburgh employs a deaf clerk, and the accompanying sketch shows the method by which he is called to the manager's room when required.

Fig. 1.—A Novel Indicator.

The inventor removed the glass front from an ordinary mechanical-replacement indicator and fitted the indicator so

that when the flag falls a large white marble drops through a hole made for the purpose in the bottom of the indicator case. The marble falling six feet on to the floor (where it is retained within an enclosure) makes sufficient concussion to ensure attention by the clerk. The marble, of course, has to be replaced by hand each time after use.

This device is in daily use, and has proved entirely successful.

Spring-Mounted Battery Carrier for Motor Vehicles.

The mounting of batteries on petrol motor vehicles has always been a difficult problem, especially in the case of industrial vehicles fitted with solid tires where the vibration set up when negotiating rough roads is great. Some motor manufacturers have mounted the batteries on springs, while others have attached them rigidly, claiming that the use of springs causes the battery to continue to vibrate after the action of the heavier vehicle springs has ceased. The accompanying illustration, fig. 2, shows the battery-mounting arrangement recently adopted by the Grant Motor-car Corporation, of Cleveland, O., U.S.A. As will be seen, the battery is mounted

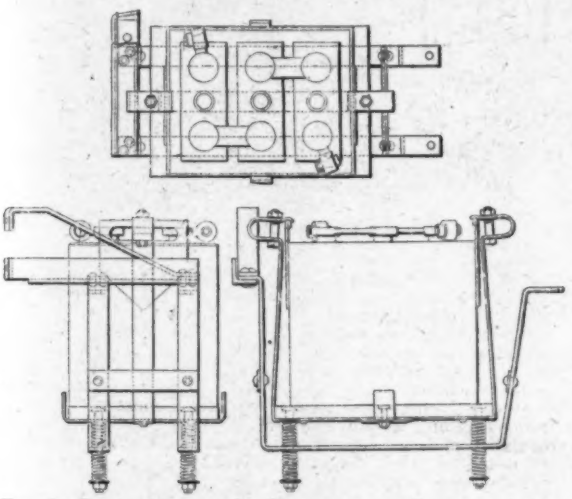

Fig. 2.—Plan, end and side Elevations of Spring-mounted Battery Carrier for Motor Vehicles.

in a cradle on four sets of springs, one half of each set being placed between the cradle and the battery and the other half below the cradle. It is claimed that the lower springs tend to counteract those on which the battery rests, so that the spring action does not continue after the vehicle springs have come to rest. A second spring cradle inside the main supporting one is provided, it having U-shaped tops with small bolts which hold the edges of the battery jar or case in place.

The Austin-Walters Rheostat Units.

Messrs. Austin Walters & Son, of Little Peter Street, Manchester, are now making electric rheostat units, which we illustrate below, for which distinct advantages over the old

Fig. 3.—The "Ohmic" Resistance Unit.

form of cast grid type are claimed. They are considerably lighter, and have a greater ohmic value in less space; they are unbreakable, rustless, perfectly ventilated, and have practically no temperature coefficient.

They can be used in any position; the illustration, fig. 3, gives a clear idea of the construction. The wire or strip used is a copper-nickel alloy of ample carrying capacity and is wound on a former with metal ends supporting four wrought-iron rods, which are insulated with mica and asbestos tubes, over which a well-spaced wire is wound and bedded. The asbestos sheets before being rolled into tubes are specially treated and impregnated, thus rendering them non-hygroscopic.

The asbestos tubes are used as a means to bed and support the wires in winding, no reliance being placed upon them for insulation. The wrought-iron rods passing through the tubes are substantially insulated with mica bushes and washers, making a sound mechanical and electrical resistance unit. The firm is at present making them in four sizes and various lengths to suit requirements in resistance work, and they are being used in the construction of the welding rheostat shown in the illustration, fig. 4.

These rheostats are built up of a number of units, to carry a current of 200 amperes by a system of paralleling, which the firm employed some years ago in the construction of

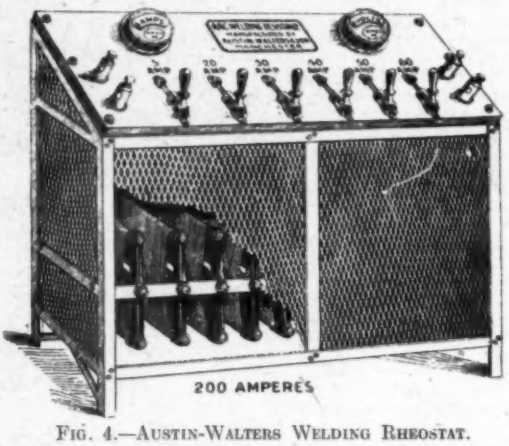

Fig. 4.—Austin-Walters Welding Rheostat.

their bioscope rheostats. The units are wound according to the currents indicated over the switches, and by a combination of the switches the current can be regulated from 20 to 200 amperes in 5-ampere steps. The units can also be used for ordinary series rheostats, and a special connecting clamp can be provided to enable various tappings to be taken as required. On account of their extreme rigidity they are suitable for heavy-current starters and portable rheostats.

In the case of the welding rheostat mentioned above, the units are fitted into a wrought iron frame having a number of slots corresponding to the number of units, so that in the case of renewal or repair the unit need only be disconnected and lifted out of the slot without dismantling the entire frame. A full list of sizes will be available shortly, giving ohmic values, carrying capacity, and weights, &c., of the rheostat units described above.

LEGAL.

Rio Tinto Co., Ltd. v. A. E. G. Electric Co., Ltd., and A. E. G. Electric Co., Ltd. v. Rio Tinto Co., Ltd. (Consolidated).

(*Continued from page* 30.)

On the fifth day of Mr. Clift's cross-examination, Mr. Colefax, K.C., said: Mr. Dufty wrote on his arrival at the mines on September 26th that he found that some ten days previously the Rio Tinto engineers had put the blower set under steam, and that up to 600 or 800 revolutions everything worked in order, but with 1,200 to 1,500 revolutions there was great vibration, and the set had to be shut down. Do you mean to say that that record was the record which a man would have made if he had had the facts before him? —I don't suggest that he had a chart before him. He wrote that he had been informed there had been several runs. The defendant had no account of what had been done with the machine before Mr. Dufty arrived because they never asked for it.

Continuing, the witness said he was cognisant of what was being done in regard to the making of the new shaft. The shaft had been run for two hours on one occasion at 1,200 revolutions. It could not have been run up to the critical speed, because it was not vibrating. When the machine was started they had never been told that there was a critical speed. As to the delay, he said there was no possible doubt that people did not like to work for the A.E.G. Co., and hence the difficulty they experienced in getting the new shaft made, but at that time there was difficulty in getting such work done anywhere owing to the pressure of Government work at the foundries.

Mr. Robert Edward Palmer, mining engineer, formerly employed by the Rio Tinto Co. at their mines, gave evidence as to the changes which were made in the plant and the substitution of the new plant for the old pyritic, and the Bessemer plant and the working of the blowers in relation to them. As to the trials when the shaft bent, he said Mr. Kelton and Mr. Dufty were present for the A.E.G. Co.

Mr. Colefax, K.C., in opening the case for the defence, said that the case had, in part, been dealt with by the arbi-

trator. It was important to note that the parties, in the agreement, set out their position quite clearly as to how the matter should be dealt with. It was that agreement which constrained the arbitrator to do what he did. The plaintiffs sought to say that in July, 1914, the reason why the tests did not take place was because of the A.E.G.'s failure to deliver plans before February 11th, 1914. That was the issue between them. Upon the facts as presented by the opening and by the evidence, there could have been no loss of output. As to the position in July, 1914, his submission was that the A.E.G. had done everything that formed any part of their obligation—that so far as they were concerned the plant was erected, and all that remained was to carry out the tests. They were prevented from doing that, not through any shortcomings on their part, but entirely because it did not suit the convenience of the plaintiffs that the test should be carried out. It was quite clear that the intention was that the people from Berlin should carry out the tests, which involved the starting up for the first time after the erection of the machine. The defendants suffered great disadvantage, not from any fault of their own. Time went on until October, 1914, when defendants were entitled to be paid the second instalment, which he submitted had been deliberately held back. He contended that the breakdown was due to the Rio Tinto people having injured the machine in attempting to run it.

Counsel then reviewed the evidence at great length, particularly in relation to the visit of Mr. Dufty to the mines and the concealment from him of what had been done in regard to the running of the machine, which he contended clearly showed that there was no defect in the design of the machine.

Mr. Richard Thomas Durran, engineer, of Victoria Street, Westminster, who prior to the outbreak of the war had been for 14 years in Berlin as manager of the foreign department of the A.E.G. (Berlin) Co., and who was a director of the English company, and now managing director pending its dissolution, gave evidence as to the business relations between the A.E.G. and the Rio Tinto Co., and the contract for the plant which was the subject of the action.

Mr. John William Flower, formerly manager of the London branch of the defendant company, and now with Dick, Kerr, Ltd., gave evidence in relation to the transactions with the Rio Tinto Co. as to the supply of turbines. He said that he saw Mr. Clift on several occasions, and he never said anything as to the shortage of steam. There would have been no difficulty in carrying out the tests in this instance if the Rio Tinto people had wished to make them. The defendants repudiated any liability in respect of the second shaft based upon the fact that the plaintiffs had run the machine without anyone else being present. In August, 1914, Mr. Clift then told him he had agreed to postpone the official test. Mr. Clift was then pressing for the starting of the engine without delay, and a proposal was made as to the payment of the second instalment of 25 per cent. in connection with the starting up. The plaintiffs sought to keep the third instalment in hand until the final test had been made. They made a proposal that the defendants should hold themselves liable—that they should be bound by the guarantee—notwithstanding that the plaintiffs had had the use of the machine. This proposal he could not accept. Mr. Clift asked whether the money would go to Germany if it was paid, and witness told him that it certainly would not as it would be paid to the Board of Trade supervisor. The Spanish erector was sent by the Seville office, and he was at the mines for three weeks. In the end they had the statement from him that the plant was in order. In his opinion it was absolutely necessary that the plant should have a detailed overhauling, because even if a small detail were overlooked a serious accident might result. Mr. Clift had never denied that under the terms of the agreement the payment had become due.

Questioned as to the negotiations which had taken place in regard to payments, the Witness said the reason why they preferred using the Spanish company's men was the difficulty which existed, owing to the war, in getting men to go out from this country. In September an agreement was arrived at under which a man should be sent out to start the machine and that an instalment should be paid as soon as the machine was working commercially. He had no idea that the machine had been started prior to that interview. In sending a man out to start up the machine they were not sending him out to repair a bent shaft. Had he known the true facts he would have been strongly opposed to the agreement.

At the conclusion of the evidence for the defence the hearing was adjourned.

(To be continued.)

New Ross (Co. Wexford) Gas Co.

In the Chancery Division of the High Court of Ireland, Mr. Justice O'Connor granted an application by this company confirming an alteration in the company's objects so as to provide for the generation of electricity for lighting, heating and power; changing the company's name to "The New Ross Gas and Electricity Supply Co."; and increasing the capital to £10,000 by the issuing of 1,000 shares of £5 each, ranking for dividend, and in all other respects, equally with the existing ordinary shares. It was stated that from the year ended March, 1909, to the year ended March, 1914, the company paid a dividend at the average rate of 8 per cent. per annum, free of income-tax; that owing to the increased price of coal and the increase in general expenses owing to the war, only 5 per cent. could be paid for the year ended March, 1915; that there was no dividend in 1916, and that 4 per cent. was paid for the year ended March, 1917. This, said counsel, showed that the company was perfectly solvent.

Bruce Peebles & Co., Ltd.

In the First Division of the Court of Session, Edinburgh, on Friday, a petition was presented for the above company for authority to summon and hold meetings of members of the company, of the mortgage debenture holders, and of the unsecured debenture holders, for the purpose of ascertaining their wishes regarding a scheme of arrangement which the company proposed to enter into with both classes of debenture holders with a view to an alteration or modification of their several and respective rights. Both classes of debentures became due on July 1st, 1918. Interest had been paid on the first debentures, but interest amounting to £30,000 upon the unsecured debentures was unpaid, but debited in the annual accounts of the company to profit and loss. The unsecured mortgagees had no right to demand payment of interest until July 1st, 1918. The object of the scheme was to convert the unsecured mortgages into preference shares of the company, with a right to at least 7½ per cent. cumulative dividend as from July 1st, 1918, and, apart from other privileges, to repayment of their capital in a winding up, and to a bonus of 50 per cent. For these rights they were asked to surrender the arrears of interest. In respect that the secured debenture holders agreed to defer for 15 years repayment of their capital, the scheme gave them 1 per cent. of additional interest. The unsecured debenture holders were practically all shareholders of the company, and interested to a much larger extent as members than they were as unsecured creditors. All the meetings were practically unanimous in approving of the scheme, and the respondents were the only parties opposing in court its sanction.

Answers were lodged for Wm. Bain & Co., Ltd., Lochrin Iron Works, Coatbridge, who submitted that the scheme was unfair and inequitable to the dissentient creditors, and that it ought not to be sanctioned. It was proposed, they said, that they and others of the unsecured debenture holders who voted against the new scheme, should be compelled (1) to surrender their accrued debt (to the extent of £27,797), and (2) to become shareholders in the venture, surrendering all the rights of a creditor in enforcing their rights by diligence should the conduct, management or prospects of the company appear to afford ground for doubt as to its future. It was also proposed for no reason whatever to give to the outstanding heritably secured debenture holders (to the extent of £49,850) a right to 6 per cent. interest per annum instead of 5 per cent.

Sir George Paul, D.K.S., to whom the case was remitted, reported that the additional 1 per cent. to the secured debenture holders seemed not to be unreasonable, as they were waiving their right to the repayment as at July 1st, of the capital of their debentures to which they were entitled. Taking into consideration the whole circumstances, the reporter said that, in his judgment, the scheme and the resolutions might be approved of by their Lordships.

Objection was taken by the respondents to the competency of the application in respect that it was presented on the authority of the directorate alone, without any preliminary meeting of the members of the company to consider it. This point of practice was decided by the Court in favour of the company.

The Division, Lord Johnston dissenting, approved of the scheme, and granted the prayer of the petition. The respondents were found entitled to their expenses in the special circumstances of the case.

WAR ITEMS.

To be Wound-up.—The Board of Trade has ordered the following to be wound up under the Trading with the Enemy Amendment Act, 1916:—Metal & Machinery Syndicate, Ltd., 56 and 57, Aldermanbury, London, E.C.2, metal and machinery merchants. Controller—P. H. Green, 60, Watling Street, E.C.4.

Trading with the Enemy.—The *London Gazette* for July 12 contains further lists of bodies and persons in the following countries with whom trading is prohibited:—Argentine, Paraguay and Uruguay; Bolivia; Brazil; Chile; Colombia; Costa Rica; Cuba; Ecuador; Honduras; Guatemala; Mexico; Morocco; Netherlands; Netherlands East Indies; Nicaragua; Peru; Salvador; Spain.

Trade Unionism After the War.—In the course of his presidential address to the General Federation of Trades Unions, Mr. O'Grady congratulated the federation on a rise in membership of 1,033,000. He is reported in the Press

as saying that after the war there would be greater need for such federations, and they must have a large accumulated reserve to enable them to resist foolish action that would unquestionably be taken by certain individual employers and by certain federations of employers. The fact that there had been very few disputes during the year did not indicate that the workers in various industries were content with the existing condition of things. The Committee on Production had provided machinery which had prevented social revolts arising from the stupidity of employers.

Women Workers After the War.—The "Times" states that as the result of two informal conferences of leading trade union women, held by the National Alliance of Employers and Employed, it has been decided to place before a large conference of all women's societies in the near future proposals embodying the following points:—

That women, while prepared to give up their present work to returning soldiers, shall not go back to their old jobs on the sweated wages that existed before the war.

That the Government should co-relate the questions of women's labour, the conversion of factories to peace industries, and the distribution of raw material in such a way as to make them inter-dependent.

That the hours of labour of the women and the returning men should be reduced to six, five, and four hours per day, so that all the women and all the men work half-time, and that as the social system resumed its normal course, and as the women went back to the pre-war industries, the hours of the men be increased to a maximum of eight.

That any scheme introduced by the Government to prevent the disabled or pensioned soldier from being exploited by low wages after the war be also made to apply to women.

Having placed these proposals before a conference of women's organisations, and of trade unions that have women members, it is proposed, says the *Times*, to put the results before the men's trade unions, then before the employers, and finally before the Government.

Exemption Applications.—At the West Denbighshire Tribunal temporary exemption until January 1st was granted to Mr. W. B. Tudman, electrician, in the employ of the Colwyn Bay U.D.C. It was mentioned that the engineer to the Council, Mr. A. R. Tudman, had received an appointment in a Government controlled undertaking, and was about to give up his appointment under the Council. The applicant was the only skilled engineer left on the work. Mr. J. Smith, the gas engineer, who will take over the management of the undertaking, supported the appeal.

At Chesterfield, an appeal was made by J. R. Turton (39, Grade 2), electrical fitter, of Saltergate. He said that he had had to close his shop owing to shortage of labour. Six months were granted.

At Mansfield, there was a National Service review of the cases of two motor men engaged with the Tramway Co., D. W. Rowland (42, Class A), and G. T. Faulkner (37, Class A). The manager, Mr. Walker, said that the men were inspectors and drivers, and owing to the shortage of labour they did more driving than inspecting, and could not very well be spared now. Conditional exemption was continued to Faulkner, and Rowland was granted three months on remaining in his present occupation.

At Hastings, Mr. H. T. Elgar appealed for the retention of Henry Southerden (47, Grade 2), electrician, the only man left to do electrical work, and who had been executing wiring for over 20 years. He was responsible for the electrical equipment of the theatre, four churches, and some schools, and if he went that department of the business would have to be closed. Three months were conceded.

At Enfield, exemptions held by E. C. Flint (40), electrical engineer, and J. C. Culliford (37), electrical lamp maker, were withdrawn as they hold protection certificates.

At Bath, in the case of F. Gilham (30, Grade 2), brakesman and car fitter with the Electric Tramways, Ltd., Capt. Little announced that the National Service headquarters had wired that reviews of current exemptions for tramway employés should not be proceeded with at present, and a month's adjournment was granted.

At Middleton, in an appeal for a switchboard attendant at the Oldham Municipal Electricity Works (29, Grade 1), it was contended that he came within the certified occupations list in which there was no age limit. It was stated that he was formerly badged. The Tribunal decided against the contention, and directed the appellant to report for service by August 1st.

At Worksop, an electrical engineer, aged 40 and Grade 2, was given exemption until October 1st.

At Watford, a review was made of the case of E. Burgin (30, Grade 1), electrician, with Messrs. Hopkins & Darley, electrical engineers. Mr. Darley is in the Army, and it was stated that Burgin was the only electrician left in the business. Conditional exemption was cancelled, and the calling up fixed for September 3rd.

Malvern Tribunal has given exemption until December 28th to C. H. Clements (36, Grade 2), electrician, with Messrs. Sparkes & Houlton.

Cranbrook (Kent) Tribunal has given B. A. W. Rowler (48), electrician, a month in which to offer himself for national service.

At Watford, a review was made of the case of R. E. Candell (42, Grade 2), electrician, in charge of the whole of the electrical plant of Messrs. Benskin. The certificate was varied to four months.

At Swinton (Lancs.), an electrician (44, Grade 1), engaged at a local print works, was refused exemption.

At Stratford-on-Avon, an appeal was made by J. Cook (47, Grade 2), electrician, of Edstone Hall, engaged with Mr. Griffiths, and he was granted conditional exemption.

Greenwich Tribunal has refused exemption to J. Wigginton (18, Grade 1), an apprentice with Messrs. Elliott Bros., Lewisham.

At Rickmansworth, on July 10th, an appeal on the ground of work of national importance was made in the case of J. Good (44, Grade 2), electrical fitter, with Messrs. Beeson and Sons, electrical engineers. Six months were granted on the man's remaining in the same occupation. Mr. S. E. Beeson (47, Grade 2), partner in Beeson & Sons, was given a similar period of exemption.

Two months' temporary exemption has been granted by the Oxford Tribunal to F. B. Stone (43, Grade 2), electrician, appealed for by Messrs. J. E. Elliott & Co., electrical engineers. G. A. Bennett (48, Grade 2), electrician at the University electrical laboratory, was granted exemption on taking up approved work of national importance.

At Rochdale, exemption until October 31st was granted to J. E. Kershaw (37, Grade 1), tramway traffic clerk, the only member of the original staff left in the traffic office. A. Worrall (31, Grade 2), and C. Robinson (30, Grade 2), motormen on the Corporation tramways, were directed to report for service by July 31st.

At the Cumberland Appeal Tribunal, an appeal was made for an electrician and motor mechanic, aged 45, married, Grade 2, by Mrs. Lamb, of Hayton House, for whom he was looking after electric lighting and power plant which cost £5,000, as well as the water supply. It was remarked, according to a local newspaper report, that the man was a "pure luxury servant for one single person alone," and he was ordered to join up.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Cable Discounts.

This morning I have no fewer than seven letters from cable-makers advising increases in prices for cables. Seeing that the whole of the seven letters are identical, it appears to be a great waste of money to send them all out.

Could not our cable makers arrange for their Association to send one notice on behalf of the whole of the firms? The much-needed economy of paper that would result from this would be very considerable.

Cable.

Heating and Cooking by Electricity.

In your current issue's leader I am quoted as having distributed to my consumers a leaflet pointing out the saving in fuel effected by the adoption of electric cooking.

This leaflet is attributed to me in error, as I am quite unaware that any consumer of mine has obtained the results stated, and I certainly have not given publicity to any such figures.

As possibly this disclaimer might suggest that I am doubtful of the authenticity of the achievement quoted, permit me to say that this is not the case.

For some time past I have been energetically recommending the use of electric cooking apparatus to my consumers, with altogether gratifying results, and I might say that, when the advisability of opening a National Kitchen in Horsham was under consideration some time ago, there is no doubt that, had the project materialised, the necessary cooking would have been done by electricity.

There is not the slightest doubt that, with current obtainable at anything like a reasonable figure, electric cooking is infinitely preferable to either gas or coal cooking—both from the points of view of economy and efficiency—and I can give instances from my own observation in proof of this.

A certain firm recently placed on the market a small oven suitable for doing the baking, &c., of a small family of from five to six persons. Three-heat regulation is provided, the top loading being 600 watts, the middle loading 400 watts, and the bottom loading 200 watts. After an initial 15 or 20 minutes on the high heat the bulk of the cooking can be carried out on either the medium or the low heat, depending upon the kind of food to be cooked. From this it will be seen that with current at 2d. per unit the cooking costs 1·2d. per hour on the high heat, ·8d. per hour on the middle heat, and ·4d. per hour on the low heat. For general cooking over a continuous period of, say, three hours, the cook can obtain satisfactory results by putting on the high heat for one hour and the low heat for two hours, giving a total current consumption for three hours' cooking of one unit, costing 2d.

This is an example for our gas friends to think about, and it is one I can prove from my own experience, as I have had in daily use for several months in my own household the oven mentioned above.

To my mind, the greatest obstacle in the way of the general use of electric cooking apparatus is the expense of boiling water in

bulk electrically, and this obstacle is, I am afraid, to a great extent insurmountable. Consumers very frequently shelve the matter of electric cooking when told that it will be advisable to install a coke boiler to obtain reasonable supplies of hot or boiling water, and, to give the Kaiser his due, this is, I am afraid, where our gas friends score.

H. L. Cottam,
Engineer and Manager, Electricity Works.

Horsham, *July 13th*, 1918.

[We regret that the leaflet in question, which was issued by Mr. Napier Prentice, managing director of the Suffolk Electricity Supply Co., Stowmarket, was erroneously attributed to Mr. Cottam. —Eds. Elec. Rev.]

Referring to the leading article in your current issue upon heating and cooking by electricity, as makers of cooking apparatus by coal, steam, gas, and electricity, it may be interesting to both pessimists and pacifists in electric cooking to learn what one firm, amongst many makers of electrical cooking equipment, is turning out for canteen restaurants at the present time. Within the last three years the output of our electrical department in canteen restaurant type apparatus, exclusive of domestic and industrial heating appliances, is, in the aggregate, round about 60,000-H.P. capacity, and the demand is still increasing. In our experience this demand for electrical cooking apparatus is chiefly due to the overall saving in money represented in labour, fuel, food, running and maintenance costs, rent, rates and taxes, floor space, cartage of coal and ashes, decoration, &c., apart from the recognised advantages and superiority of electricity as a heating medium compared to flame methods, in its simplicity and convenience of operation, perfection in cleanliness, and hygienic working conditions.

Given cheap electricity for the million, and hiring powers for apparatus such as are enjoyed by the gas interests, electricity will undoubtedly take first place in our homes and restaurants, &c., for cooking, heating, cleaning, lighting, and other labour-saving devices.

For the Falkirk Iron Co., Ltd.,
C. G. Nobbs.

Falkirk, *July 15th*, 1918.

BUSINESS NOTES.

Manufacturers' Council.—The Federation of British Industries, the British Empire Producers' Organisation, and the Imperial Council of Commerce have formed a Joint Council :—

1. To consider and report upon any questions of mutual interest reflecting the common aims of the three bodies—viz., to ensure the conservation and development of the industry, production, and commerce of the United Kingdom and her Overseas Dominions, and submitted by any one of the three constituent bodies.
2. To initiate the consideration of any such subject, and
3. To take any action in relation to such subjects that may be specifically authorised by the constituent bodies.

By means of this Joint Council concerted action will be possible between accredited bodies representative of the business interests—both industrial and commercial—of the United Kingdom and the Overseas Dominions, and its recommendations will naturally carry weight with the Government.

Book Notices. — *Technical Supplement to the Daily Review of the Foreign Press.* London : H.M. Stationery Office. Price 6d. net (fortnightly).—One of the tasks of the General Staff at the War Office during the war has been the issue of a daily review of the foreign Press, the scope of which has been extended from time to time by the preparation of supplements dealing with special subjects. A fortnightly technical supplement, compiled with the co-operation of the Institution of Civil Engineers, was added to the list in January last, and since then has been widely circulated through official channels, for the assistance of naval and military workers. It has been warmly welcomed by those entitled to receive it, but its usefulness has been limited hitherto by the fact that it has been inaccessible to many professional men and firms to whom it would be of interest. This limitation has now been removed by the decision to place the technical supplement on sale, and the issues of May 28th and subsequent numbers may be obtained, at the cost of 6d. each, through any bookseller, or directly from H.M. Stationery Office. Information extracted from the foreign Press is noted as briefly as possible, full summaries being given only in the case of articles of special interest. In addition, a technical information service is available to answer inquiries from Government Departments or engineers desiring information on engineering questions generally, so far as this is obtainable from technical literature, engineering societies' records, or similar sources.

Two pamphlets relating to the testing of scientific glassware have been received from the National Physical Laboratory ; one gives instructions as to the method of sending such apparatus to the Laboratory, the other describes the nature and scope of the tests, for which a special building is being erected and equipped.

"Thermal Expansion of Alpha and of Beta Brass Between 0° and 600° C., in Relation to the Mechanical Properties of Heterogeneous Brasses of the Muntz Metal Type." By P. D. Merica and L. W. Schad. (Scientific Papers of the Bureau of Standards, No. 321, May, 1918.) Washington : Government Printing Office. Price 10 cents.

"Science Abstracts." Sections A and B. Vol. XXI. Part 6. June 29th, 1918. London : E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Dynamo and Motor Attendants and their Machines." Ninth edition. By Frank Broadbent. Pp. xv. + 212 ; 107 figs. London : S. Rentell & Co., Ltd. Price 3s. 6d. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII, No. 7. July, 1918. New York : The Institute. Price $1.

"The Post Office Electrical Engineers' Journal." Vol. II. Part 2. July, 1918. London : H. Alabaster, Gatehouse & Kempe. Price 1s. net.

"Wireless Telegraphy and Telephony." By W. H. Eccles. Second Edition. Pp. xxiv. + 514 ; 434 figs. London : Benn Brothers, Ltd. Price 22s. net.

U.S. Exports of Electrical Goods.—The disappearance of German competition has greatly favoured the expansion of the American electrical industry. Owing to the export restrictions in vogue in France and England, the United States is about the only country at present that is in a position to replace Germany in the world's market. The following figures will show the great progress made by the United States in the exportation of electrical goods since the war :—For the years ending June 30th, 1914, 133,000,000 fr. ; 1915, 105,000,000 fr. ; 1916, 160,000,000 fr. ; 1917, 275,000,000 fr. These figures show that the value of exports for 1917 was 70 per cent. above those of 1916 and 105 per cent. above those of 1914.—*American Machinist.*

Trade Announcements.—As from July 24th the address of Mr. Archibald Campbell is altered to 8, Wolseley Road, N. 8. Telephone : "North 2601."

Owing to military service, Mr. E. Craggs, electrician, of Sheerness, has had his stock sold by auction.

Catalogues and Lists.—Stanton Ironworks Co., Ltd., near Nottingham.—Pocket illustrated catalogue of c.i. socket and spigot pipes, flanged specials, manhole covers, surface boxes, &c.

Messrs. Higgs Bros., Summer Hill Street, Birmingham.—Stock list of standard shunt-wound protected motors from ·17 H.P. to 22 H.P.

Fuller Accumulator Co., Ltd., Woodland Works, Chadwell Heath, Essex.—Illustrated leaflet respecting the "Fuller" electric safety lamp.

Automatic and Electric Furnaces, Ltd., 6, Old Queen Street, London, S.W. 1. Pamphlet dealing with the correct normalising of carbon steel.

New State Steel Works in Australia.—The immediate establishment of State steel works in Queensland is recommended by the Royal Commission.—*The Times.*

A National Trade Mark.—We have received a circular of 16 pages, in which Mr. Paul E. Derrick, of Norfolk Street, Strand, sets forth a "statement of the case" for National Trade Marks for the identification of the origin of commercial products.

Non-Ferrous Metal Industry.—The President of the Board of Trade has appointed the following Committee to hear applications under the Non-Ferrous Metal Industry Act : Sir D. Stewart-Smith (chairman), Mr. C. A. Russell, Sir H. Elverston, M.P., Mr. H. J. Mackinder, M.P., Sir E. Hiley (Federation of British Industries), and Mr. E. Manville (Association of Chambers of Commerce). The secretary to the Committee is Mr. C. R. Woods, Board of Trade, Gwydyr House, Whitehall, London, S.W. 1.

A list of further licences granted under the above Act appears in the *London Gazette* for July 12th.

Liquidations.—A. Vernon-Ward (London), Ltd.—Under the compulsory winding-up order made last March, the report of Mr. H. E. Burgess, Official Receiver, has been issued to the creditors and shareholders. The accounts filed under the liquidation show liabilities £22,635, assets valued at £6,981, and a deficiency of £29,581 as regards contributories. The company was incorporated as a private company on May 17th, 1915, for the purpose of carrying on the business of electro-therapeutists &c. The nominal capital was originally £10,000, and was subsequently increased to £20,000. The directors were Messrs. A. Vernon-Ward (who died on December 15th, 1917), A. Lewis, and A. J. Wells. The issued capital was £14,148, of which £3,835 was subscribed for cash. The company in May, 1915, acquired from the Natural Radium Ore, Ltd., certain therapeutic plant and effects for £250 cash and a debenture for £2,000 issued to Mrs. Vernon-Ward. The directors further undertook to pay to Mrs. Vernon-Ward £9.998 in consideration of services rendered and expenses incurred in connection with the formation of the company ; also to discharge all trade liabilities of the vendor company. In August, 1916, the company acquired from Mrs. Vernon-Ward the exclusive licence for making, using, and vending an apparatus for applying electric treatment for curative and other purposes. The consideration was £1,000 in cash and certain royalties. The company had no capital at the commencement, the cash subscribed shares not being issued till the end of 1915 and early 1916. In the meantime, assistance was rendered by Mrs. Vernon-Ward, who provided the company with the proceeds of sale of certain other vendor shares. The business of the company was apparently conducted and controlled entirely by Mr. Vernon-Ward, who dominated the board. His remuneration was never fixed, and he drew upon the company's funds without restraint, his drawings amounting to about £5,000 per annum. These drawings were, upon his instructions, debited to the account of Mrs. Vernon-Ward, in all

probability for the reason that he was an undischarged bankrupt, and Mrs. Vernon-Ward is now returned as a debtor for £13,103, the balance standing to the debit of her account. A. Vernon-Ward (Hove), Ltd., A. Vernon-Ward (Manchester), Ltd., and A. Vernon-Ward (Consolidated), Ltd., were companies formed with similar objects to the London company. The provincial companies appear to have lent considerable sums to the London company, and all the companies accommodated each other from time to time. According to the statement of affairs, the London company is indebted to the provincial companies as follows:—A. Vernon-Ward (Hove), Ltd., £2,281; A. Vernon-Ward (Manchester), Ltd., £4,592; and A. Vernon-Ward (Consolidated), Ltd., £6,546. In October, 1917, the company acquired an invention for the alleviation of deafness. The failure of the company is attributed to Vernon-Ward's extravagance, to insufficient working capital, and to excessive interest paid on money borrowed. Mr. A. F. Dickin, C.A., has been appointed liquidator, with a Committee of Inspection.

GENERAL ENGINEERING ACCESSORIES, LTD.—Meeting, August 14th, at 120, Blackfriars Road, S.E., to hear an account of the winding up from the liquidator, Mr. H. Chapman.

Patents and Alien Enemies.—The B. of T. announces in the *London Gazette* that all licences that have been granted, authorising the payment of fees for the grant, registration, or renewal of patents, designs and trade marks in an enemy country, or for applications on behalf of enemy subjects, payable in this country and the Dominions, are revoked, and that in future all such payments are prohibited.

LIGHTING AND POWER NOTES.

Aberystwyth.—PROPOSED HYDRO-ELECTRIC SCHEME.—Prof. O. T. Jones submitted to the T.C. a report on the proposed hydro-electric scheme, and stated that he had come to the conclusion, with an assumed average rainfall of 60 in., that, without large storage and careful regulation of the discharge, it would not be safe to reckon upon more than 21 H.P. on a 50-ft. fall under the most unfavourable conditions, though for many years it might not fall below 60 or 80 H.P. He had also made calculations assuming the average rainfall to be as high as 80 in., in which case power yielded under unfavourable conditions on a 50-ft. fall would be between 39 and 48 H.P.

Australia.—VICTORIA.—HYDRO-ELECTRIC SCHEME.—The River Latrobe Hydro-Electric Co. has been formed with a capital of £20,000 to install a 250-H.P. hydro-electric plant to supply the towns of Warragul, Neerim, Drouin, and Trafalgar with electricity for light and power purposes. Mr. V. J. Crowley, A.A.I.E.E., is consulting electrical engineer and manager of the company.

MELBOURNE.—The City Council has adopted the recent proposals for the licensing of wiremen, and has appointed a representative to accompany the deputation which is to wait on the Minister for Public Works with the object of seeking legislation on the subject.—*Commonwealth Engineer.*

Barnsley.—The T.C. has decided to appoint an independent expert to advise on the electricity supply in the district.

Bath.—The paragraph entitled "Bristol," in our last issue, should have appeared under the heading of "Bath."

Bootle.—PRICE INCREASE.—The T.C. has increased the charges for electricity, from September 30th next, for lighting, power, and other purposes by 17½ per cent., making a total war advance of 30 per cent. In cases where the charges are made and adjusted to the variation in the price of coal, the price will be increased by 12½ per cent.

Bradford.—YEAR'S WORKING.—The Corporation electricity department accounts for the past financial year show that the energy sold exceeded 55,500,000 units, compared with 46,000,000 in the previous year. The total income was £237,000, against £200,000, and the net income £10,860, or £951 less than in the preceding year. Coal cost £18,300 more than in the previous year, and other causes of increased working cost have been the increases of wages. Capital charges increased by £4,750.

Burton-on-Trent.—PRICE INCREASE.—The T.C. has increased the price of electricity by 35 per cent. for power, and by 15 per cent. for lighting.

Bury St. Edmunds.—MAINS EXTENSION.—The T.C. has decided to extend the electricity mains to the Fornham Road district, at a cost of £625. It was stated at a meeting of the Council that the railway company contemplated using electric power in connection with its wagons.

Canada.—NEW E.S. COMPANY.—The Corporation d'Energie de Montmagny, Ltd., has been formed, with a capital of $400,000, to supply electricity and gas in the counties of Lotbiniere, Levis, Dorchester, Beance, Bellechase, Montmagny, L'Islet, Kamouraska, and Temiscouata.—*Electrical News.*

WATER POWER.—An Order has been issued by the Ontario Government authorising the production of 130,000 H.P. at Nepigon, New Ontario, with the object of developing the mineral resources of that district. The Ontario Government has also authorised an increase in the electrical equipment at Niagara Falls to the amount of £100,000, and the development of 300,000 H.P. on the Rideau and St. Lawrence rivers. Sir Adam Beck stated that the Commission could supply the American side with 200,000 H.P. by the autumn of 1919, increasing by 30,000 H.P. a month until the maximum of 300,000 H.P. was reached. It is hoped to have available in five years 2,250,000 H.P., equivalent to 50,000,000 tons of anthracite coal a year.—*The Times.*

Carlisle.—ANNUAL ACCOUNTS.—The annual report of the Corporation's electricity undertaking for the past year shows a net profit of £1,295, compared with a loss of £196 in the previous year. The units sold, the income derived, and the output had been in advance of all previous years.

Carshalton, Wallington, and Cheam.—PRICE INCREASE.—The price of electricity to these places has been revised as under, as from the Midsummer quarter, by the South Metropolitan E.T. and L. Co.:—Lighting, 6d. per unit, + 10 per cent.; power and heating, a war charge of ¼d. per unit.

Continental.—SWEDEN.—Among the new electricity undertakings recently formed in Sweden are the Sundals Ryrs Kraft Aktiebolag, formed at Sundals Ryr, with a maximum capital of £11,500, and the Ulf Elektriska Aktiebolag, Ulvekamn. Both will acquire water-power rights, and establish hydro-electric stations in their respective districts.

SWITZERLAND.—It is stated that the United States is to make representations to Switzerland against the "export" to Germany of electric power in large quantities for military workshops, and also against the export of aluminium in quantities exceeding those provided for by agreement.

Dromore (County Down).—PRICE INCREASE.—The U.D.C. has granted permission to the E.L. and P. Co. to increase the charges for electricity for lighting and power by ¼d. per unit.

Edinburgh.—ANNUAL ACCOUNTS.—The past year's working of the Corporation electricity department resulted in a loss of £2,956; this has been met from the reserve fund, which now stands at £99,838. During the past four years the deficit on the undertaking has amounted to £21,946.

Farnham.—The 1914 E.L. (Extension) Order has been extended for another year.

Hemsworth.—PROPOSED E.L. POWERS.—The R.D.C. has deferred consideration of a notification from the Electrical Distribution of Yorkshire, Ltd., of the company's intention to make application for electric lighting powers in the Council's area.

India.—OIL FIELD ELECTRIFICATION.—The *Indian Textile Journal* understands that contracts have been invited by Burma oil companies for electrifying their oil-field equipment, at an estimated outlay of £1,500,000.

Lepton.—PROV. ORDER.—The U.D.C. has consented to the application of the Huddersfield Corporation to the B. of T. for a prov. order to supply electricity for public and private purposes within the district.

Newcastle-under-Lyme.—LINKING-UP.—The Electricity Committee has instructed the Stoke-on-Trent Corporation to lay the main connecting the Newcastle-under-Lyme and Stoke-on-Trent electricity works.

Oldham.—ANNUAL ACCOUNTS.—The report of the Corporation electricity department for the last financial year shows a revenue of £79,405. The expenditure was £47,907, and the net profit £7,572, compared with £9,032 in the previous year. The number of units sold for lighting purposes was 1,859,520, against 1,814,635; for power, 9,636,926, against 9,338,100; street lighting, 33,187, against 3,609; and traction, 3,653,455, against 3,349,666, a total of 15,183,088, against 14,506,010, an increase of 4·67 per cent. The revenue showed an increase of 8·04 per cent. The number of lamps, &c., equivalent to 32 watts, was 439,361, an increase of 13,279, and the number of consumers 2,893, an increase of 50. The cost of production increased from 0·69d. to 0·75d. per unit, and increased war wages amounted to £2,546.

Reading.—Mr. G. F. Craven, general manager of the Corporation Tramways Department, has been appointed Local Fuel Overseer for the borough.

Rhodesia.—LOAN.—The Umtali T.C. has borrowed £12,000 for the purpose of installing an E.L. scheme.

Rickmansworth and Chorleywood.—PROV. ORDER.—The B. of T. has extended the prov. order by one year.

Salford.—LINKING-UP.—The T.C. has accepted a tender for cable for the purpose of linking-up the Salford electricity supply with that of Manchester. The Manchester electricity department reports that the first instalment of the new underground mains is now being laid. The voltage is 33,000.

Salisbury.—Proposed Purchase.—The T.C. has referred to the General Purposes Committee for consideration the question of the option to purchase the undertaking of the E.L. and S. Co.

Silsden.—Proposed E.L. Powers.—The District Council has decided to refuse consent to the application of the Electrical Distribution of Yorkshire, Ltd., for powers to supply electricity in the area.

South Africa.—Loan.—The Wellington (Cape Province) Municipality proposes to borrow £8,000 for an electric lighting scheme.

Stockton-on-Tees.—The electrical engineer having presented a report and estimate (amounting to a total of £10,150) for providing an alternating-current three-phase supply from a substation erected in the Stockton area, the matter has been referred to the Lighting Committee for consideration.

Stratford-on-Avon.—Electricity Charges.—The T.C. has decided not to sanction any further increase in the price of energy supplied by the Electricity Co.

U.S.A.—New York.—The big electric lighting companies have arranged for insurance covering bombardment from the air or the sea and other forms of war risk. From $7,000,000 to $10,000,000 has been taken out by the New York Edison Co., and three millions is said to have been taken by the United Electric Light and Power Co.

Walsall.—Loan Application.—Application is to be made to the L.G.B. by the T.C. for sanction to borrow £6,304 for the electricity undertaking.

Wigan.—Price Increase.—The Electricity Committee has increased the price of electricity for lighting purposes by a further 12½ per cent., making 25 per cent. over pre-war rates. The charges are now as follows:—Churches and offices, 6½d. per unit; shops and dwelling houses, 5d.; theatres, restaurants, &c., 3¾d.

Windsor.—Proposed Bulk Supply.—The T.C. has decided to take no action in the application of the Slough and District E.S. Co. to supply energy in bulk to the Windsor Electrical Installation Co.

TRAMWAY AND RAILWAY NOTES.

Bradford.—Year's Working.—The accounts of the Corporation tramway department for the year ended March 31st last, show an income of £366,495, an increase of £40,090 on the previous year. The average income per car-mile was 15·89d., compared with 13·67d. Traffic expenses amounted to £115,800, as against £99,700, the principal item being £47,000 for wages, an increase of £28,000. The rail-less system showed a deficit of £2,760, though account has to be taken of the feeding value of this system to the remainder of the undertaking. The gross profit was £87,180, and, after payment of interest and sinking fund, the net profit was £31,376, compared with £30,802 in the previous year. The reserve and renewals account now stands at £111,048.

Burnley.—Annual Accounts.—For the year ending March 31st, 1918, the receipts of the Corporation tramway department amounted to £96,967, against £87,039 in the previous year. The total working expenses were £68,203, or 10·64d. per car-mile, compared with £58,604, or 9·08d. per car-mile. Interest and sinking fund absorbed £15,531, rent £1,546, and income-tax £3,818, and £6,389 was carried to the reserve fund, against £5,222 last year.

Continental.—Germany.—The scarcity of means for carrying goods has rendered it highly desirable to be able to adapt ordinary road vehicles so that they may be run on tramcar rails or on ordinary roads.

An article in *Zeitschrift des Vereines Deutscher Ingenieure*, March 16th, describes, with illustrations, an under-carriage enabling a vehicle to run on tramcar rails or on ordinary roads. The arrangement has been put into operation at Düsseldorf.

Each of the main axles of a road vehicle is provided with a pair of auxiliary axles with small running wheels. These auxiliary axles are situated on either side of the main axle to which they are bracketed by swivelling arms. When running on roads all four auxiliary axles are raised from the ground, and the vehicle runs on its road wheels. When it is required to run on rails the auxiliary axles are let down and the load is wholly or partially transferred to the auxiliary wheels. This transfer is effected by operating a crank handle attached to chains by which the auxiliary axles are pulled downwards, thus raising the vehicle off its road wheels.

Electric Vehicle Progress.—A comparison of the cost of doing the same work of refuse collection by electric tipping wagons and by horse haulage, shows how great has been the saving through the use of the former. At Chester we note that, as compared with the cost of doing the same work by horse haulage, the saving during the period in which the electrics have been in service is of the order of £788, or rather more than the amount which has had to be put by in the same period in order to pay for the vehicles in four years. The two vehicles had together travelled 13,688 miles, collected and carried 5,974 tons of house refuse, delivered 217 tons of fuel to the electricity works, and conveyed 167 tons of shell and 256 tons of scrap steel to the railway station. The working expenses for the same period were per mile:—Drivers' wages, 4·50d.; repairs, 0·24d.; materials, 0·60d.; insurance, 0·20d.; electrical energy, 2·65d.; maintenance of tires, 1·00d., a total of £517, or 9·19d. per mile.

The income derived by the cartage of fuel, shell, and scrap steel amounted to £48, making the net cost of carting refuse, excluding interest and depreciation, £469.

The two vehicles are found to do the work of six horses, carts, and men. These, if obtainable, would have cost for hiring £1,517. Drivers employed with the horses and carts also assist in filling the latter, so that, in order to get a fair comparison, their wages should be deducted from the cost of hiring. Each man devotes approximately two-thirds of the day to driving from house to house and collecting, and one-third driving to and from the tip. For the purpose of comparison, the drivers' wages are allocated in equal amounts to collecting and driving, which reduces the hiring figure by £257, making the figures for comparison:—Six horses and carts, £1,260; two electric vehicles, £471, leaving a balance in favour of the "electrics" of £789. The amount set aside in the period for the repayment and interest was £733 6s. 8d. The vehicles were supplied by Messrs. Edison Accumulators, Ltd.

At Pontypridd the figures on the first six months' working of two Edison 2-ton electric tipping wagons make a good showing for electric service, as the saving over the cost of doing the same work by horses was no less than £354, which is at the rate of over £700 a year.

Electricity is charged at 1½d. per unit, and the average consumption is 2·8 units per mile. It should be remembered that the district is a hilly one. The initial cost of each vehicle was £1,020, and for two vehicles the annual charge for interest and repayment of loan (10 years) at 6 per cent. accounts for £280. Insurance at £15, repairs, renewals, and maintenance at £100, and an allowance of £15 per annum for cleaning, bring the total of the fixed annual costs to £410.

The working expenses for the six months, during which the two vehicles handled 4,730 tons of refuse, are given as follow:—Wages (including war bonus and overtime), £389; fixed costs (interest, repairs, &c., half of £410), £205; electricity, 21,695 units at 1½d., £136; tires, 7,744·70 miles at 1d., £32, a total of £762; cost per ton, 3s. 2·69d.; average cost of horse haulage per ton, 4s. 9d.

Glasgow Cleansing Department employs both petrol and electric vehicles, as well as horse haulage. The cost per ton of refuse handled is:—For electric vehicles, 2s. 10·65d.; for petrol vehicles, 3s. 9·52d.; for horse haulage, 3s. 3·15d.—*Electric Vehicle.*

Keighley.—Year's Working.—In his report on the past year's working of the tramway department, the borough electrical engineer states that the adoption of the penny-all-the-way fare has proved a success. The revenue increased by £2,042, and there was a net profit of £1,211. There was a loss on the rail-less system of £457, the car-mileage run being 57,158, against 73,277 in the previous year.

Leeds.—Mr. B. Hamilton, manager of the tramways department, has been appointed Local Fuel Overseer for the City of Leeds, under the Household Fuel and Lighting Order, 1918.

Liverpool.—Strike.—The tramway strikers returned to work on Friday last, pending arbitration.

London.—Underground Railway Accident.—Through the fore part of a City-bound train jumping the metals and tearing up part of the permanent way between Baron's Court and Hammersmith Stations, traffic was interrupted for several hours on Wednesday evening, last week.

Accident.—On July 13th a double-deck tramcar overturned whilst taking the sharp curve at the north end of Blackfriars Bridge. Two persons were injured.

Subsidised 'Buses.—With reference to the subsidy granted by the Government to the L.G.O. Co., the *Daily Chronicle* states that the Metropolitan Municipal Tramways have appointed a Committee to investigate the matter.

Woolwich.—The L.C.C. has applied to the B. of T. for an extension of time to August 7th, 1919, for the construction of the tramways in Eltham Road and High Street.

Northampton.—Wages Dispute.—The Corporation employés, who had given notice to strike on Saturday last unless their war bonus was increased to £1, have decided to accept an advance of 1d. per hour, but request that the question of the 12½ per cent. go to arbitration. Cease work notices have been suspended pending a Town Council meeting.

Sheffield.—Annual Report.—The annual report of the Corporation tramway and motor-bus undertaking for the year ended March 25th shows total capital expenditure of £1,230,496, and the total sum provided out of revenue for sinking fund amounted to £525,043. For the tramway section, total income was £601,446; total working expenses amounted to £413,730, or an average of 10·17d. per car-mile, being an increase of 1·83d. per car-mile on the previous year. Gross profits were £176,679, and income-tax on profits £27,339, leaving a balance on the year's working of £83,904, a decrease of £4,575 on the previous year. For the motor-omnibus section, total income was £47,641; working expenses, £36,774; gross profits, £7,084, leaving a net balance on the year's working of £4,042.

The amount paid in allowances to dependants of enlisted men was £11,363. Passengers carried numbered 153,506,213, an increase of 10,954,666; car-miles run were 9,761,994; traffic revenue

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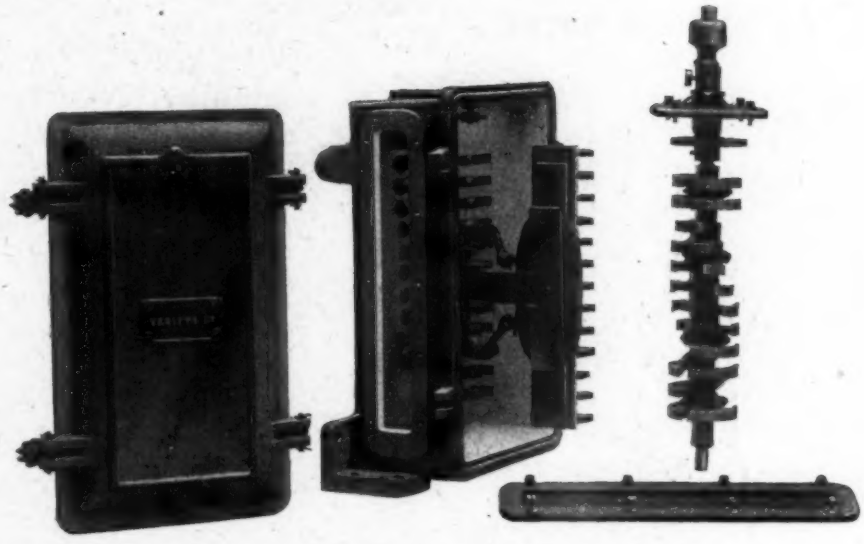

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BIRMINGHAM: Phœnix Chambers, Colmore Row.

BRISTOL: 59, Victoria Street.

MANCHESTER: Hardman Street, Deansgate.

NEWCASTLE-ON-TYNE: Edinburgh Life Assurance Buildings, 21, Mosley Street.

GLASGOW: 51, Waterloo Street.

LIVERPOOL: 518, Royal Liver Buildings.

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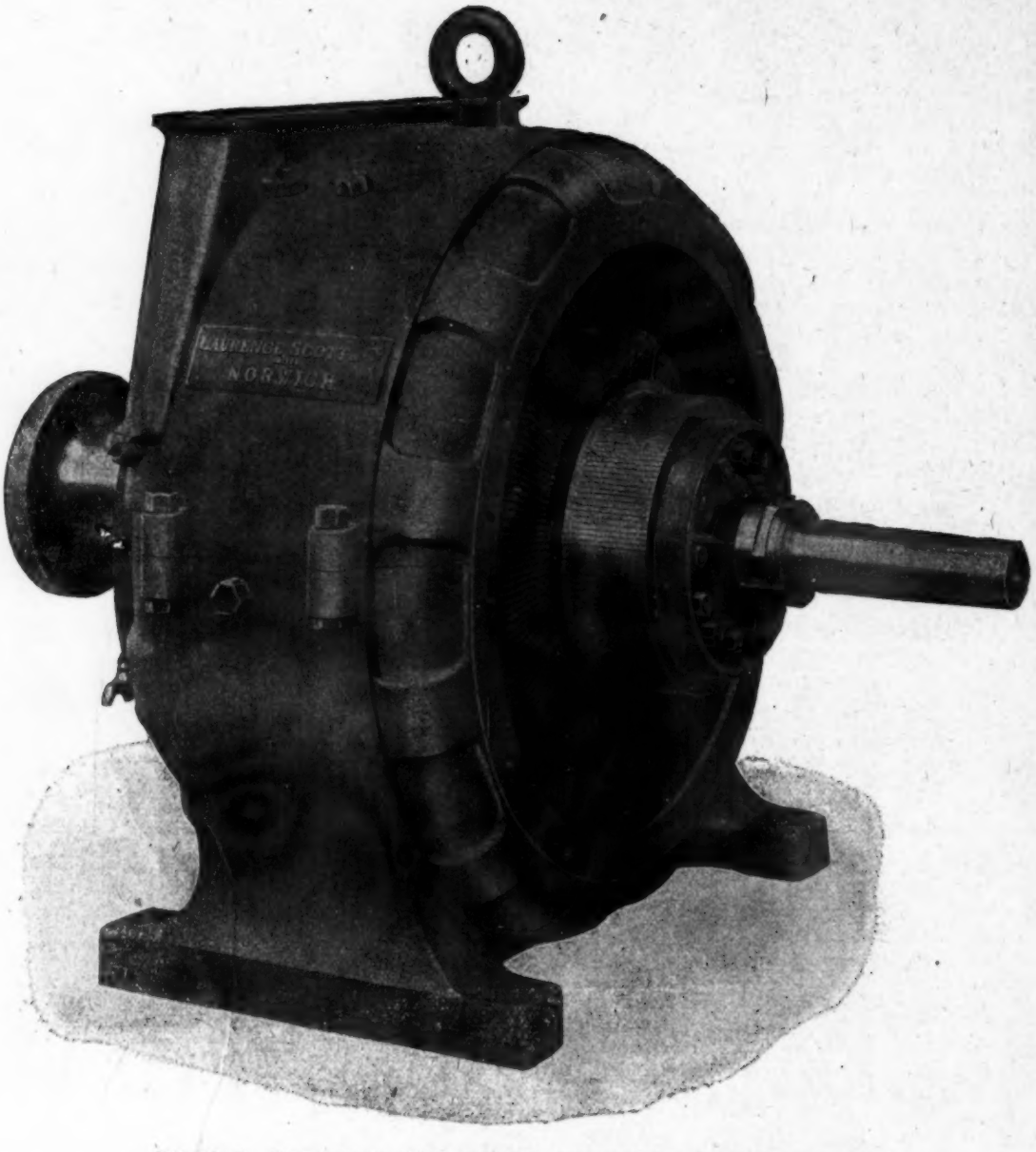

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AS SUPPLIED IN LARGE NUMBERS TO ARSENALS, DOCKYARDS, EXPLOSIVES WORKS, CHEMICAL WORKS, FACTORIES, ETC.

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Supplied Single or Double-Pole.

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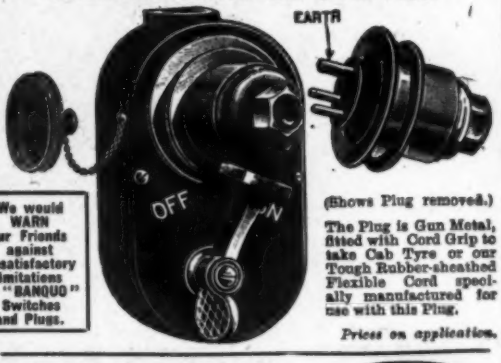
With loose or removable keys, 1/4 per way ex.

NUMBER OF SINGLE POLE 5-AMP. SWITCHES.

1	2	3	4	5	6	7	8	9	10	11	12
5/0	9/4	14/-	18/8	23/4	28/-	32/8	37/4	42/-	46/8	51/4	56/-

Prices for Double-Pole and 10-amp. Switches on application.

"BANQUO" SAFETY INTERLOCKING COMBINED WATERPROOF SWITCH AND 3-PIN PLUG.



We would WARN our Friends against Unsatisfactory Imitations of "BANQUO" Switches and Plugs.

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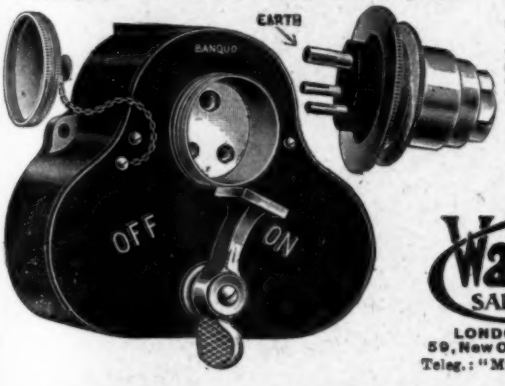

Combined Double-Pole SWITCH, with Interlocking Plug, so arranged that the plug can only be inserted or withdrawn when the switch is in the "OFF" position.

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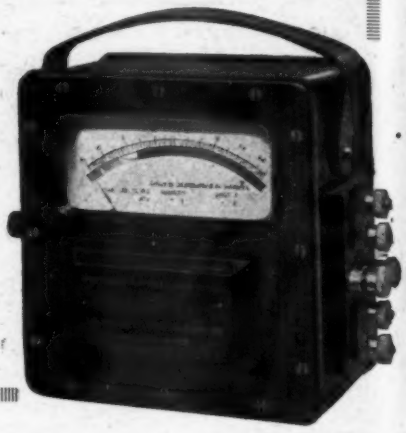

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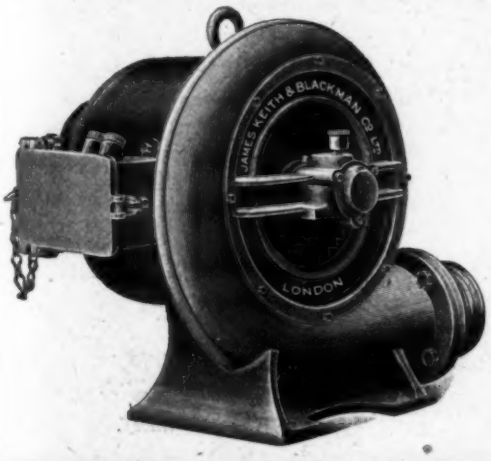

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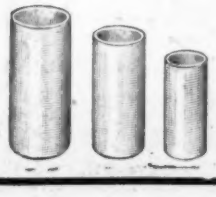

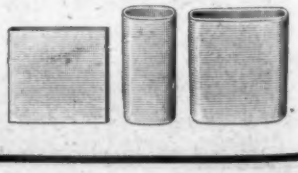

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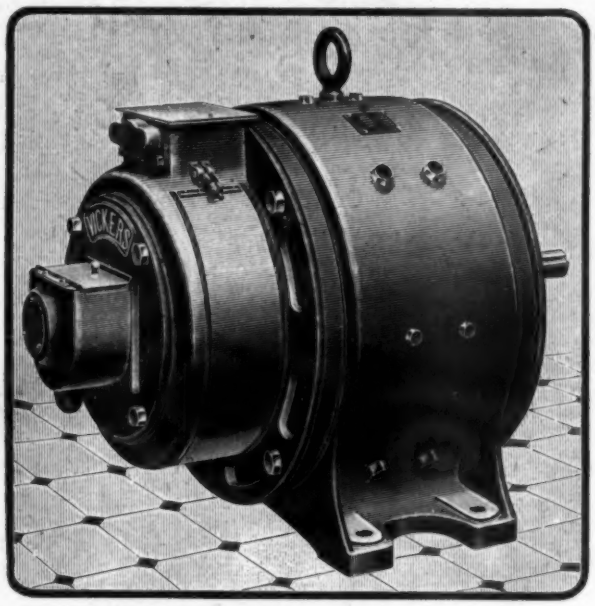

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SITUATIONS VACANT.

Latest time for receiving 9.30 a.m. Thursday.

SHIFT ENGINEER.

WANTED, a Shift Engineer at the Stretford Electricity Station.—Applications, stating experience, to be addressed to R. ROWLAND, Engineer, Electricity Works, Chester Road, Stretford, from whom particulars as to wage and bonus may be obtained. 2088

ENGINEER-IN-CHARGE.

ENGINEER-IN-CHARGE wanted for Diesel station. Applicants must be competent to cary out repairs, and have had A.C. experience. State experience and salary required, to MANAGER, Electricity Works, Staines. 1986

SITUATIONS VACANT.—*Continued.*

CITY OF BIRMINGHAM.

Electric Supply Department.

APPOINTMENT OF DRAUGHTSMEN.

SENIOR and Junior Draughtsmen are required by the above department for the layout of a large electrical power station, turbines, boilers, piping and switchgear. Only men who have been employed on similar class of work need apply.

Commencing salary for the Senior Draughtsmen will be £150, rising to £200 per annum, at the discretion of the Electric Supply Committee, plus £52 per annum war bonus, plus 12½ per cent.

Commencing salary for the Junior Draughtsmen will be £100, rising to £130 per annum, at the discretion of the Electric Supply Committee, plus £52 per annum war bonus, plus 12½ per cent.

Application to be made by FRIDAY, the 26th instant, on a form to be obtained from the SECRETARY of the Department.

R. A. CHATTOCK,
City Electrical Engineer.

14, Dale End,
Birmingham. 2092

HORSHAM URBAN DISTRICT COUNCIL.

Electricity Department.

APPOINTMENT OF CHIEF ASSISTANT ENGINEER.

THE above-named Council invite applications for the position of Chief Assistant Engineer at their electricity works (certified undertaking).

Applicants should have had a good mechanical and electrical training, and be thoroughly familiar with the routine work of a 3-wire D.C. station with destructors. Mains and meter experience essential.

Applications, endorsed "Chief Assistant Engineer," giving full particulars of training and experience, together with copies of testimonials, and stating inclusive salary required, to be sent to the undersigned not later than SATURDAY, the 27th of JULY instant.

By order of the Council,
H. L. COTTAM,
Electrical Engineer.

Electricity Works, Horsham.
17th July, 1918. 2114

ROTHERHAM CORPORATION ELECTRICITY SUPPLY.

Junior Shift Engineer.

WANTED immediately, Junior Shift Engineer, with 3-phase and D.C. experience.

Good wages, bonus and 12½%, and prospects of early promotion to suitable applicant.

State age, experience and medical grade.

EDWARD CROSS.

Electricity Works,
Rawmarsh Road, Rotherham. 2102

ASSISTANT RAILWAY TELEGRAPH ENGINEER.

REQUIRED for the Ceylon Government Railway for two years' service with possible extension. Salary £400 a year for first year, and £500 a year thereafter. Free passages.

Candidates, who must be qualified electrical engineers, with a thorough knowledge of railway telegraphs and Tyer's tabular system, and acquaintance with telephony, should apply at once by letter, giving full details of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1. 2066

SWITCHBOARD ATTENDANT.

SWITCHBOARD ATTENDANT required for an H.T. Power Station. Wages 35s. per week, + 15s. 6d. bonus, + 12½% for seven 8-hour shifts per week.

State medical category, age, experience, and enclose copies of testimonials, to the ENGINEER, Electricity Works, Redditch, Worcestershire. 2023

ASSISTANT ENGINEER.

ASSISTANT ENGINEER required for 3-wire D.C. station (certified undertaking); must have had experience in both power station and mains work.

Apply, stating full particulars of experience and salary required, to—

CHIEF ENGINEER & MANAGER,
Electricity Works, Leek, Staffs. 2006

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

SHIFT ENGINEER.

SHIFT ENGINEER required for certified undertaking engaged on munitions work: Babcock & Wilcox boilers, turbo-generators and 11,000-volt 3-phase supply.

Apply, stating full particulars of experience, military service, age, &c., and salary required and when available, to—

KENT ELECTRIC POWER CO.,
Railway Street, Chatham. 2106

SWITCHBOARD ATTENDANT.

SWITCHBOARD ATTENDANT required for 3-wire D.C. station (certified undertaking). Experience with batteries essential.

Apply stating age, full particulars of experience and wages required, to—

BOROUGH ELECTRICAL ENGINEER,
Electricity Works,
Barnstaple, N. Devon. 2097

DESIGNING DRAUGHTSMEN.

WANTED, several experienced Designing Draughtsmen, having sound engineering and, preferably, marine and electrical experience, for Government experimental work on the Clyde.

2119, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

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ELECTRICAL FITTERS (ineligible) required for switchboard erection and general repairs. 51-hour week; overtime at standard rates. Wages £1 19s., plus £1 war bonus, plus 12½% bonus on total earnings. Apply to—

ELECTRICAL ASSISTANT TO C.R.E.,
Archcliffe Fort, Dover. 2116

WIREMEN.

WIREMEN (ineligible) required for general maintenance. 51-hour week; overtime at standard rates. Wages £2 6s. 9d., plus 12½% war bonus on total earnings. Apply to—

ELECTRICAL ASSISTANT TO C.R.E.,
Archcliffe Fort, Dover. 2117

DERBY CORPORATION ELECTRICITY DEPARTMENT.

WANTED, Switchboard Attendant, wages 60s. per week plus 12½ %. 48-hour week.—Applications endorsed "Switchboard Attendant," stating full details, should be addressed to—

BOROUGH ELECTRICAL ENGINEER,
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Derby. 2085

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ARMATURE Winder required for electric railway shops, South London District. No one now employed on Government work will be considered.—Apply, stating wages required and full particulars, to 1969, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winders, used to repair shop, D.C. work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply H. D. & S., 32, Newington Causeway, S.E. 1686

ASSISTANT Departmental Superintendent in large London factory. The following qualifications given preference:—Technical college training; electrical experience. War work. Permanency for good man. Good prospects. Must be ineligible or discharged from Army. No person resident more than 10 miles away, or already on Government work will be engaged.—Apply stating age, experience and salary required, &c., to 2105, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT (technical), for Patent Agent's Office in London. Must be of good education, with a knowledge of engineering, both electrical and mechanical. Acquaintance with the French and German languages would be an advantage. Sedentary employment suitable for rejected or discharged or disabled service man. Good salary.—Write Box 641, Sells, Ltd., 168, Fleet Street, E.C. 4. 5100

SITUATIONS VACANT.—*Continued.*

ASSISTANT to Machine Shop Manager wanted by London controlled establishment; must have good experience in rapid and economical production of small parts on capstans, drilling and milling machines, and presses, and in the design of jigs and tools. No person on Government work, or living more than 10 miles away, engaged.—State age, salary required, and full particulars of experience, to 5095, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineer wanted for certified power station, Midlands A.C. and D.C. supply trams, destructor, batteries, boosters. Applicants must have had mechanical and electrical training; pay to commence 60s. weekly, including all bonuses to date.—Apply, with full details of age, experience, if married, present position and pay, when at liberty, to 2026, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

COUNTER Assistant required for Wholesale Electrical House. Must be experienced. Preference given to discharged soldier. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write stating age, experience and salary required, to 5101, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

COUNTRY House.—Engineer-Electrician wanted; two Crossley Gas Engines, with dynamos; set of D.P. Batteries supplying current at week-ends, and Permutit Water-Softening Plant. Quarters provided. State wages wanted.—SIR JOHN BRUNNER, Silverlands, Chertsey. 2124

DESIGNING Engineer for electrical machines wanted by large firm in Midlands. Must be thoroughly experienced mechanical man with good shop experience. No person already on Government work will be engaged.—Apply, stating experience, age, and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. A5684. 2069

DRAUGHTSMAN.—Designer required, able to offer competitive designs in ironclad switches and switch fuses. No person resident more than 10 miles away, or already on Government work, will be engaged.—1961, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN, experienced in Ship Electrical Installation work, required. State experience, age and salary. No person already on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 2033.

DRAUGHTSMAN wanted for Jig and Tool work, also Draughtsman for Switchgear work (Tyneside). No person already on Government work will be engaged.—Apply stating age and salary expected to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 2021.

DRAUGHTSMEN. Applications invited from first-class men experienced in any of the following classes of work:—(a) H.T. and L.T. switchgear; (b) Detail mechanism; (c) Motor control gear. Permanent and progressive employment. Manchester district. No one already on Government work need apply.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5652, and stating age, experience and salary required. 2030

DRAUGHTSMEN. Good mechanical men wanted by electrical engineering firm in Lancashire, for control gear, contactor and liquid type. Experience in this particular class of work not essential. Permanency to suitable men. No one already engaged on Government work will be employed.—Apply stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning N. A5649. 2031

ELECTRIC Lamps.—Man wanted with practical knowledge of exhausting and capable of doing repairs. No one already on Government work, or residing more than 10 miles away, will be engaged.—RENEW LAMP CO., 847, Harrow Road, N.W. 10. 5133

ELECTRICAL Accessories, &c.—Sales Counter Assistant required; some experience necessary. Applicants must either have received their discharge or be ineligible for military service. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write in first instance, stating experience, wages required, to SUN ELECTRICAL CO., LTD., 118, Charing Cross Road, W.C. 2. 2046

ELECTRICAL Engineer. Designing Engineer wanted by large electrical firm in Lancashire, used to the design of control gear. One with knowledge of contactor gear preferred. No one already on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5653, and stating age, experience and salary required. 2029

ELECTRICAL Fitter wanted with Tramway Motor experience.—Write or call MANAGER, 590, Lea Bridge Road, Leyton, E. 10. 1777

ELECTRICAL Foreman wanted shortly for Clyde shipbuilding yard. Must have had experience of large contracts for Admiralty and Mercantile ship installation; a strict disciplinarian, good organiser and energetic man essential. No one already on Government work need apply.—Give full particulars, experience, age, and salary expected, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5700. 5082

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

ELECTRICIAN required, accustomed to lighting and bell repair work; permanency for suitable man; must be ineligible for military service. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply, KNIGHT, Electrical Contractor, Gerrards Cross, Bucks. 5132

ENGINE Fitter for private power station (London). Experience of Belliss engines preferred. Constant employment, wages 65s. per week.—2113, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER and Manager wanted for small D.C. supply station, seaside. Must have experience of Diesel engines, and be of low category. State full particulars and salary required.—1974, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER to take charge of and run country house electrical installation, consisting of two oil engines, dynamos, refrigerator, electric lighting and telephones; ability to drive a petrol lorry occasionally if required, will be an advantage; Kent, 40 miles from London; house provided.—Applications, stating age, experience, when at liberty and salary required, to be sent to 2086, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ESTIMATING Clerk wanted by a Controlled Establishment in Midlands, preferably with experience of telephones or small electrical apparatus. The position is permanent, with good prospects for suitable applicant with the right qualifications. No person already on Government work will be engaged.—Apply stating age, experience and wages required, to your nearest EMPLOYMENT EXCHANGE, quoting No. A5645. 2025

EXPERIENCED Foreman or Forewoman required to take charge of flashing and mounting department, carbon filaments. No person resident more than 10 miles away, or already on Government work, will be engaged.—9728, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FITTER-Driver required for Suction-Gas Plant and Direct-Current Dynamos. Good wages to qualified man.—Apply RESIDENT ENGINEER, Electricity Works, Hitchin. 2121

GOOD Plumber-jointer, with E.H.T. experience, wanted at once in large works in South; permanency for suitable man.—Reply, stating age, experience, and wages required, to 2001, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

HOTEL Engineer required (used to controlling the mechanical electrical plants, &c., of a large establishment), for first-class Lancashire Hotel; to replace man called for military service. Good wages to a suitable, responsible man.—Write fully to 4995, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

JUNIOR Shift Engineer required for large electric power station (certified undertaking), A.C. and D.C. Good experience and prospects. Wages £2 15s. weekly inclusive rate.—Apply, SHROPSHIRE, WORCESTERSHIRE & STAFFORDSHIRE ELECTRIC POWER CO., Power Station, Downing Street, Smethwick. 2077

LEAD Burner wanted, used to small portable battery work. Preference given to man having some experience of repair work. Permanency for suitable applicant. No person resident more than 10 miles away, or already on Government work, will be engaged.—5072, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MANAGER (Electrical) for large wholesale firm in Scotland, for duration of War only. Must have a thorough practical and technical knowledge of the trade, and be conversant with all Admiralty and War Office requirements; first-class commercial experience and exempt from military service; salary £300 to £350.—Address, with full particulars, 1926, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MAINS Assistant.—Applications are invited for this vacancy stating experience, age and salary required; experience of H.T. alternating current systems essential.—Apply, BOROUGH ELECTRICAL ENGINEER, Electricity Works, Dover. 2108

PLUMBER-Jointer wanted with good experience of high and low-tension lead-covered cables and cable maintenance generally. Wage 9½d. per hour for 50-hour week, with £1 and 12½% bonus.—Apply, stating particulars of experience, and when work could be commenced, to the GENERAL MANAGER, Electricity Department, Dunning Street, Sunderland. 2082

PURCHASING Department.—An Assistant, with previous experience of such work, is required by a large engineering company in the Midlands. Applications from discharged soldiers possessing the necessary qualifications, will receive special consideration. No one at present employed on Government work will be engaged.—Apply, stating salary required, and giving full details of experience, to your nearest EMPLOYMENT EXCHANGE, quoting No. A5629. 2009

REQUIRED, Second Assistant Engineer for electric supply undertaking with tramways; must have mechanical experience.—State age, salary required, and military classification, to MANAGER, Electricity Works, Weston-super-Mare. 5079

SHIFT Engineer wanted for C.C. station; steam and Diesel engines.—Apply stating experience, with copies of testimonials, stating wages required, to the MANAGER, Wycombe (Boro') Electric Light & Power Co., Ltd., Lily's Walk, High Wycombe. 5051

SITUATIONS VACANT.—*Continued.*

SHIFT Engineer required for large sub-station, in steel works taking three-phase E.H.T. supply from outside, and supplying L.T. direct and alternating current for works' use, by means of rotary converters and static transformers respectively; duties consist of seven 8-hour shifts per week. Candidates for post must have held similiar positions, and are required to state at the time of application, details of their training and experience, age, salary required, and earliest date upon which they could commence their duties after appointment. Persons already employed on Government work will not be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A5702. 2087

SHIFT Engineer wanted in State Controlled Establishment to take charge of alternate day and night shift; Diesel and gas engines, D.C. plant. Only men not engaged on Government work, and free from military service, also thoroughly experienced, need apply.—Applications, giving full particulars, to be made to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5483. 2075

SHIFTMAN, preferably knowledge driving Diesels or internal-combustion engines, for H.T. station; wages 45s. to 60s. according to experience.—Apply ELECTRICITY WORKS, Sundridge, Sevenoaks. 5135

SUPERINTENDENT required for 6000-KW. power station in Scotland. Must have first-class mechanical and boiler-house experience, and, preferably, with 3-phase E.H.T. experience. Good salary to thoroughly reliable man.—Apply, giving salary expected, age, married or single and date on which duties could be commenced, 2056, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant required to take charge of 2000-volt A.C. Switchboard and superintend running; 56 hours per week. Good wages to suitable man.—Apply RESIDENT ENGINEER, Electricity Works, Chelmsford. 2122

SWITCHBOARD Attendants wanted for Station in North Midlands with 3-wire D.C. lighting, traction and E.H.T. 3-phase, with rotaries running direct and inverted. State age, experience and salary required.—2063, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TECHNICAL Assistant wanted with knowledge of Switchgear and experience in commercial correspondence and handling of Specifications. No person already on Government work will be engaged.—Apply by letter to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 2028.

TEST Assistant wanted, with experience of contactor panels, relays, &c. Good prospects and wages, according to ability. No person already on Government work, will be engaged.—Apply, giving full particulars of experience, age, &c., to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5726. 2110

TEST-Room Assistant wanted for general calibrating and adjusting of electrical measuring instruments, D.C. and A.C. Applicants must be exempt or ineligible for military service and not engaged on Government work, or resident more than 10 miles away. Apply stating previous experience and wages required. London district.—2099, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

THREE or Four first-class Wiremen required for an emergency contract in the Taunton district, between August 4th and 11th. No person already on Government work will be engaged.—Apply by letter to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 2109.

WANTED an Armature Winder; must be ineligible for military service; good wages to suitable man.—Reply, giving full particulars of training, experience and age, to 2084, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, an experienced electrical Storekeeper; good wages and opening for the right man; preference given to a discharged soldier. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply, stating age, full particulars and wages required, to MANN, EGERTON & CO., LTD., 177, Cleveland Street, W. 1. 2103

WANTED, an experienced Wireman-Jointer for maintenance work on mains, motors and meters.—Apply, stating wages, and copies of testimonials, to CHIEF ENGINEER AND MANAGER, Electricity Works, Leek, Staffs. 2008

WANTED at once, thoroughly good up-to-date Armature Winder, with knowledge of general winding, for small D.C. machines in quantities. Must be able to act as leading hand, and capable of taking full charge when foreman is away. No person resident more than 10 miles away, or already on Government work, will be engaged.—State age, full experience and wages required, to 2050, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by a firm in the S.E. district engaged on munition work, first-class Telegraph Mechanics. No person resident more than 10 miles away, or already engaged on Government work, will be engaged.—State age and experience to 6125, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

WANTED, Electrical Engineer with a knowledge of D.C. machine design. Nobody engaged on Government work need apply.—Apply, giving particulars of age, experience, and salary required, to SIEMENS BROTHERS DYNAMO WORKS, LTD., Stafford. 2083

WANTED, Electricians used to power work. No person resident more than 10 miles away, or already on Government work, will be engaged.—MACDONALD, SYER & CO., LTD., 295, Gray's Inn Road, W.C. 2073

WANTED, General Assistant to Works Manager in an old-established electric lamp factory. Good opening and progressive salary. No person already on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A5667. 2037

WANTED immediately, Engine Driver for steam and Diesel engines; also Stoker accustomed to Babcock & Willcox boilers; willing to train suitable men.—Apply RESIDENT ENGINEER, Electricity Works, St. Albans. 2098

WANTED on a Scottish Power Company (Certified Undertaking), a Shift Engineer with good mechanical and electrical training. Good wages to a man thoroughly experienced in E.H.T. 3-phase work and boiler house control.—Reply giving full particulars, with copies of references, to 1975, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Shift Engineer for Power Station, A.C., three-phase, E.H.T. and D.C. supply. Wages £3 10s. per week and overtime.—Apply, giving full particulars of past experience and testimonials, to the MANAGER, Sheerness and District Electric Power and Traction Co., Ltd. 2052

WANTED, temporarily, for duration of war, man, ineligible for military service, as Chief Accountant for large electrical power undertaking. Must be competent to take charge of five sets of books and prepare annual balance sheets and statements of accounts for audit in the form prescribed by statute. Must also be experienced in the preparation of periodical revenue accounts, financial statements, interest and dividend lists, &c. Knowledge and experience of modern cost of electric power undertaking essential. Duties include supervising collection of accounts of 2,000 consumers.—Apply, stating full particulars, including official military disqualification and wages required, 2080, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Works Fitter for the running of a D.C. three-wire station. The person appointed must be fully conversant with water-tube boilers, steam turbines, &c. Salary £3 10s. per week (inclusive).—Apply with full particulars, to THE URBAN ELECTRIC SUPPLY CO., LTD, Hawick, N.B. 2089

WIREMEN wanted, permanency. Good wages. Electricity Undertaking in the Midlands.—Reply stating age, rate and experience, to 2049, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A CHARGE Engineer-Electrician desires change, steam, gas, Diesels, boilers, pumps, lighting, power. Good refs., low category.—5075, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

A MECHANICAL and Electrical Engineer (A.M.I.E.E.), 42 years of age, having had 20 years' exceptional experience on erection of buildings and installation and maintenance of heavy electrical, hydraulic and other power plants, is prepared to consider offers for executive or other position of responsibility where tact, energy, and ability are required. Good organiser and thoroughly accustomed to the control of men. Salary required, £600.—5017, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, 18 years' experience testing laboratories, power stations and works, requires change, meters, instruments, motors and dynamos, cables and batteries.—5104, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

APPRENTICE to Draughtsman.—Parent wishes to place son, age 15; E. or N.E. London preferred.—ANDREW, 142, Hale End Road, Walthamstow. 5102

ASSISTANT Electrician wants job; good refs. Experienced; ineligible.—A. MARTIN, High Street, Colnbrook. 5106

CHARGE Engineer desires change; good mechanical and electrical experience; Grade 2.—5117, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHIEF Draughtsman, shortly disengaged; over 20 years' extensive workshop and electrical instrument experience and jig and tool design.—5037, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

COMMERCIAL Electrical, 20 years' general experience. Home and export connection.—5018, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN (Junior).—Youth, 16½ years, just left technical school, requires situation with Electrical Engineers.—YOUNG, 153, Taybridge Road, Battersea, S.W. 11. 5099

ELECTRICAL and Mechanical Engineer, A.M.I.E.E., A.M.I.M.E., age 42 years; workshop training, 20 years' central station plant mains, tramways experience in responsible positions, 10 years in present post, desires change, first-class references; salary about £350 for permanent post.—5085, ELECTRICAL REVIEW, 4, Ludgate Hill, London

ELECTRICAL Engineer (A.M.I.E.E.), chief assistant of large supply undertaking in North of England, desires change to South or Midlands; exceptional experience; salary required £400.—5089, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, full of energy and enterprise, shortly disengaged; used to control of men, capable organiser with initiative, keen buyer, good estimator, and well up in theory and practice, present sales engineer to supply company; work of national importance essential, 20 years' experience, excellent references.—5121, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, with college degree and experience in the running and testing of large electrical machines and turbines, desires post as Assistant Engineer or Supervisor. Ineligible.—5076, ELECTRICAL REVIEW, 4, Ludgate Hill, London,

ELECTRICAL Fitter, discharged from Army, desires change. All-round experience, especially in maintenance of power plant in large establishments. Good references.—5113, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Fitter (28) Grade 3, desires change, health reasons, Cornwall and West Country preferred; experienced in all inside and outside central-station and factory routine.—5093, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN desires berth, national importance, sound experience, dynamos, motors, lighting accumulators, steam engines; charge of plant preferred. Age 35.—BROWN, 601, Romford Road, Forest Gate, E. 7. 5077

ELECTRICIAN or Shift Engineer, seeks berth, A.C. and D.C., erection of installations, plant, or station work.—5080, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN wants berth national importance; thoroughly experienced dynamos, motors, lighting steam plant. Charge of plant preferred. Age 35.—BROWN, 601, Romford Road, Forest Gate, E. 7. 5119

ELECTRICIAN'S Assistant seeks engagement, London or country age 17. State wages, terms.—BURSTEN, 8, Mendip Houses, Globe Road, E. 5078

ENGINEER (A.M.I.E.E.), age 36, desires change in responsible position; 17 years' experience, 13 years as chief assistant in large supply undertaking. Excellent references.—5011, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, Electrical and Mechanical (age 33), desires position of responsibility on work of national importance. Experienced in the design and manufacture of various kinds of small electrical apparatus, theoretical and practical. At present in charge of the entire design and manufacture of motors and appliances of a special kind.—5114, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, working, 14 years' experience, seeks charge of plant-controlled works, doing all own repairs. Erecting, &c., both electrical and mechanical. Excellent testimonials. London or suburbs.—5109, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ESTATE Electrician seeks charge of large estate or institution plant.—5045, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOREMAN Electrician, thoroughly experienced power, lighting, telephones, good supervisor, able to estimate, seeks position with responsible contractor, London district.—5083, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LIGHT Employment wanted. Man 50, ineligible. Has been in charge of private plant over two years. Knowledge of Ironmonger's business.—DAWS, Hitchen Hatch Lane, Sevenoaks. 5118

MAN (33), discharged, seeks berth, Accumulator Mechanic; would go as electrician's mate. Good references.—E. H., 4, Cambridge Cottages, Hackney, E. 9. 5105

MANAGER or Foreman. 26 years' experience. Complete installations, light and power, telephones, &c., estimating and office control. Government work only.—5122, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

SITUATIONS WANTED.—*Continued.*

OUTDOOR Forman Erector, of general millwright work, also lifts, cranes, runways, transporters; last position six years; competent to handle men and material, energetic, abstainer, good timekeeper.—5086, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

RESPONSIBLE post required (scheduled as a protected occupation) as Electrical Engineer or Supervising Electrician. Maintenance or erection of new plant preferred. Engineering and steel works' plant experience; accustomed to armature winding.—4988, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TELEPHONE Faultsman, first-class, experienced all systems, seeks change.—5084, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WIREMAN, young, experienced, wants job. Army discharge.—E., 349, Fulham Road, S.W. 5120

AGENCIES.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.).
Box Number and ELECTRICAL REVIEW address count as seven words.

AN important London firm of merchants with special electrical department wishes to represent in Italy, France, Switzerland, and Spain, firms manufacturing electrical porcelain insulators and fittings, also electrical lamps and/or other articles for electrical industry.—Write, giving full particulars, stating terms, to 5091, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LOCAL Agents wanted in every town to collect old Electric Lamps on Commission.—Write, 104, Craven Park, London, N.W. 10. 4932

FOR SALE.

MACHINERY FOR SALE.

5-FT. Radial Arm Drilling Machine, by Whitworth; 2¼" spindle; slotted bed-plate. Ditto, 4' 6" arm, tapping motion, boxed table.
Treble-geared Facing and Boring Lathe, by Buckton; 84" face-plate; strong tool.
Cold Iron Saw, by Isaac Hill; ditto, by Becker, for two saws.
50-H.P. Stockport Gas Engine; 20-H.P. Crossley; 16-H.P. Tangye.
Vertical 3-throw Geared Pumps, 7½" rams, engine driven. Set 6½" ditto, motor driven, 550 volts.
115-KW. Generating Set, 220 volts.
C.I. Tank, 25' × 17' × 4' 6"; 12,000 gals.
600-H.P. Horizontal Compound Tandem Condensing Steam Engine, rope fly-wheel 18' dia.
Large stock of other machinery.
Further particulars and prices—
J. T. WILLIAMS & SONS,
37, Queen Victoria Street,
London.
Telephone: City 3938. Works: Hop 834. 1998

FOR SALE.

DYNAMOS, 100 v., 220 a., 900 revs. (Mather & Platt), compound, with spare armature.
110 v., 50 a., 1,100 revs. (Scott), shunt.
500 v., 120 a., 500 revs. (Crompton), 6-pole, interpole single bearing.
230 v., 65 a., 650 revs. (Brush), 4-pole, compound, single bearing.
Motor-generator, 230 v. to 65 v., 40 a. (Newton).
Porthole fan, 24-in., 230 v., 800 revs.
Three Siemens Mining Switches, double automatic, 300 a., 3-pole.
"Robey" Vertical Steam Engine, 10 and 14 × 9 inch.
"Gardner," 1½ H.P., Horizontal Oil Engine, with base to take belt-driven dynamo.
Motors, all sizes, A.C. and D.C.
Switchboards, Cable from 61/12s., Resistances, Carbon Lamps (60 and 65 v., 32 C.P.), Shades, Meters, &c. Send enquiries.
MERCIER, 25, Union Street, Liverpool. 2067

FANS AND MOTORS.

ONE 12", 200-volt, 50-period, oscillating Desk Fan.
One 12", 100-volt, 100-period, ditto.
Two 12", 100-volt, 50-period ditto.
One 12", 65-volt, D.C. ditto.
Five 10", 100-volt, 50-period, Desk Fans.
One 8", 200-volt, 50-period, ditto.
One 8", 100-volt, 50 period, ditto.
Three 12", 200-volt, 50-period, ditto.
Three 12", 100-volt, 100-period, ditto.
Four 12", 100-volt, 50-period, ditto.
One 1/16-H.P., 200-volt, 50-period, 2,000 R.P.M., Motor.
One 1/8-H.P., 100-volt, 50-period, 1,200 R.P.M., Motor.
One 1/10-H.P., 100-volt, D.C., 900 R.P.M., Motor.
All new; going cheap.
Apply to "B," 19, Gun Street, Bishopsgate, E. 1. 2090

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

3" by 26" Jones & Lamson, all-geared head Flat Capstan Lathe.
3½" Centres "Lo Swing" Lathe on 8" bed.
2' by 24" Jones & Lamson Flat Capstan Lathe.
Motor-Driven Face Milling Machine, by Hetherington and Co., with facing head 18" diam.
Hori. Boring and Facing Machine, by Noble & Lund, T-slotted table, 2' by 2' 2".
Snout Boring Machine, Worm Driven, T-slotted table, 2' 7" by 2' 6".
Portable Slotting Machine, 4' 6" stroke, with swivelling head arranged for motor drive.
Sellars Patent Hori. Tool Grinding Machine, to take tools up to 2½" by 2½".
No. 3 Four-spindle "Acme" Automatic Screw Machine for ⅝" bars.
Gear-driven Duplex Screwing Machine, by Dron & Lawson, with dies up to 2½" diam., Whitworth thread.
CATALOGUE of Stock MACHINERY. 2-3000 LOTS.
Free on Application. Inspection invited.
THOS. W. WARD, LTD., ALBION WORKS,
Tel.: "Forward, Sheffield." SHEFFIELD.

R. H. LONGBOTHAM & CO., LTD., WAKEFIELD,
and at Milburn House, Newcastle-on-Tyne.
Tel: { 44 Wakefield. / 867 Newcastle. Telegrams: "Engineer, Wakefield."

FOR SALE.

ONE Parsons Steam Turbo Set, 3500 KW., 1200 R.P.M., with alternator field-rotating type and exciter complete; 6000-volt maximum load, 40 cycles.
One ditto, 1500 KW., 2-phase, 2000 volts, 50 periods.
One Willans-Parsons Steam Turbo Set, 1200 KW., with Alternator, 1200 R.P.M., 200 lbs. to sq. in., 11,000 volts, three-phase, complete with exciter, also condensing plant, air, and circulating water pumps, &c.
One Parsons Turbo-Alternator, 300 KW., two-phase, 2000 volts, 50 periods.
One 225-KW. Generating Set, engine tandem comp. type, 300 H.P., with Corliss Valve Gear, &c., B.T.H. Generator, 500 volts, compound wound. 5277

MACHINERY FOR SALE.

GENERATING SETS, D.C.

One 500-KW. Willans-E.C.C., 420/500 volts.
Three 256-KW. Belliss-Siemens, 460/500 volts.
One 220-KW. Willans-A.E.G., 220 volts.
One 200-KW. Allen-Parker, 460/500 volts.
One 180-KW. Anderson-Mavor 220/230-volt Set.
One 160-KW. Belliss-G.E.C., 460/500 volts.

TURBO-GENERATORS, A.C. AND D.C.

One 1,000-KW. A.E.G. 500 volts, 50 cycles, 3-phase, with condensing plant complete; the whole equal to new.
One 500-KW. Parsons, 460/530 volts, with condensing plant complete.

Apply, FRANK GILMAN,
Lightwoods Hill, Birmingham. 2015

MOTORS, SWITCHES AND FUSES AND STARTING GEAR.

A.C., 2 and 3-phase, 200 v., 400 v., 50 periods, 5, 7, 10, 15, 25, 27, 30, 35 H.P.
D.C., 220 v., 440 v., 1, 2, 5, 10, 15, 20, 25, 30 H.P.
Power Cables, Distribution Fuseboards and Switches.
Safety Automatic Devices for either A.C. or D.C. circuits.
Concrete, sound materials and workmanship.
Guaranteed 18 months.
"ROBUST MACHINERY," 62, Bradford Street, Walsall. 2040

BATTERY FOR SALE.

700-AMP-hour Battery, 126 cells, for Sale, complete. Almost in new condition.
2070, ELECTRICAL REVIEW,
4, Ludgate Hill, London, S.E. 4

(*Continued on next page.*)

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

ONE Generating Set Comprising :—

"Howden" Enclosed Compound Engine for 150 lbs. steam pressure, direct-coupled to compound interpole generator, having an output of 300 KW. at 240 volts, 375 r.p.m. ; built in 1910, and in first-class order.

Specification and print on request.

THE PHŒNIX ELECTRICAL CO.,
32—36, Broomielaw, Glasgow. 1943

GAS ENGINES AND ALTERNATOR.

FOR Sale, 10-B.H.P. Andrews Stockport Gas Engine, two fly-wheels and pulley, tube ignition.

89-B.H.P. Crossley Gas Engine, X.A.E. type, with extra heavy fly-wheel, electric lighting engine, magneto ignition.

142-B.H.P. Crossley Gas Engine, Z.A.E. type, with extra heavy fly-wheel, electric lighting engine, magneto ignition.

One 70-KW. Elwell-Parker single-phase Alternator, wound for 110 or 220 volts, with separate exciter.

Can be seen running.

CRYSELCO LIMITED, Kempston Works, Bedford. 2107

ELECTRIC MOTORS.

SALE or Hire. Second-hand Machines in Stock. ARMATURES and Coils repaired at shortest notice.

THE TITAN ELECTRICAL CO.,
9/11, Eagle Street, W.C.

'Phone : Central 13,191.

ARC LAMPS AND METERS.

FOR immediate disposal, about 200 Continuous Current Davy Arc Lamps with Carbons, 230 volts pressure, and a quantity of house service type and switchboard type Meters.

Particulars on application to BOROUGH ELECTRICAL ENGINEER, Corporation Electricity Works, St. Helens. 2016

D.C. MOTORS.

D.C. MOTORS for Sale, 8, 14, 22, 40-B.H.P., 440 volts, slow speed. Certificate required.

2047, ELECTRICAL REVIEW,
4, Ludgate Hill, London, E.C. 4.

TELEPHONE SWITCHBOARD.

FOR Sale, 50-line Central Battery Telephone Switchboard, complete with instruments, in first-class condition. Delivery from stock. Suitable for aircraft factory or other large establishment. Complete installation undertaken.

2118. ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

VARIOUS ELECTRICAL PLANT.

VARIOUS Electrical Plant for Sale, including 15-line telephones, radiators, desk fan and motor, B.T.H. fan motor, electric light fittings and globes, motor starters, switches, &c.

HANS RENOLD, LTD.,
Burnage Works,
Didsbury, Manchester. 2123

ELECTRIC DYNAMOS AND MOTORS.

MACHINES always available for Sale or hire.
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FOR SALE.—*Continued.*

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2111, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

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BATTERIES (defective), American make, 3 volts, 2½" diameter, 6" height. Large quantity.—ASCOG, LTD., 57, Hope Street, Glasgow. 5044

COMPLETE Plant. Suction Gas producer, 15-H.P. Crossley engine, Brush dynamo, 100-volt. Large Tudor battery. Can be seen running.—Apply through ELECTRICITY WORKS, Sundridge, Sevenoaks. 5136

D.C. Motors, 230 v., ¼, ½, ¾, 1, 1½, 2, 3, 4, 5, 7, 10, 12, 20 H.P. ; Motors, 460 v., 1, 2, 2½, 3½, 4, 5, 6, 8, 10, 15, 20, 30 H.P. ; Motors, 110 v., ¼, ½, 1, 2, 3, 4, 5, 7, 8, 9, 10, 12, 25 H.P. ; in order.—5126, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

D.C. STARTERS, to 150 H.P., in all types. Shunt Regulators, all sizes, Starter Panels, Switches, Voltmeters, Ammeters.—5128, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMO, by Peto & Radford, 135 volts, 40 amps., 1,080 revs. Price £30.—WATSON, 277, Abbey Road, Belvedere, Kent. 5097

DYNAMOS, 110 volts, 30 amps., complete with rheostat and slide rails, carbon brushes, ring oilers, price £22 ; one enclosed ditto 35 volts, 5 amps., £6. — HARRISON, 42, King William Street, Coventry. 5092

DYNAMOS, 200/250 v., 21, 48, 60, 82, 98, 180, 450, 650 amps. ; Dynamos, 110 v., 12, 20, 26, 40, 50, 60, 70, 90, 100, 125. 520 amps. ; in order.—5124, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMOS, 3000, 1500, 1000 and 750 amperes at 6 volts ; also smaller sizes. Apply for lists.—CANNING & Co., Electro-Platers Engineers, Birmingham. 7769

ELECTRIC Motors and Dynamos, Sale or Hire. Always a large stock of nearly new guaranteed machines. Immediate delivery.—ELECTRO-GENERATOR CO., 1A, Shepherd's Bush Road, W. 'Phone : 488 Hammersmith. 4723

ELECTRIC Motors for sale, A.C. and D.C. ; good numbers in stock ; immediate delivery. — SUGDEN, Wakering Road, Barking. 4915

FOR Sale, about 1 ton Mica Flake and 5 cwt. Mica Dust. In London.—2112, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Cable, 1,000 meg. (Association), nine coils 7/22, six 7/20, one 1/16.—Best offers to 5108, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Converter or Charging Set, 200 volts, 13·5 amps., 115 volts, 20 amps., with Starter, Switchboard and connections.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 2010

FOR Sale, Crypto Auto-Converter, in new condition ; 480 volts, D.C.—60 volts, 80 amps., 1580 R.P.M. : price, with starting panel, £78. Crypto Dynamo, 15 amps., 110 volts, 1600 R.P.M., £18. —E. P. ALLAM & Co., 107, Gray's Inn Road, W.C. 1. 2093

FOR Sale, Dynamo, 115-volt, 44 amps., compound wound ; Motor, 5 H.P., 110-volt, 1,200 revs., shunt, interpole ; Plating Dynamo, 6 volts, 50 amps.—5116, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Motor-Generator, by the G.E.C., 500 volts, 225 amps., with two series-wound boosters, 110 volts, 400 amps., 650 R.P.M.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 1996

FOR Sale or Hire.—10-H.P. Swedish, 460 volt ; 5-H.P. Woolnough, 440 volts ; also 220 volts, 1 H.P., 2 H.P., 3½ H.P. ; 400/480 volts, 1 H.P., 2 H.P., 2½ H.P., 3 H.P., 3½ H.P. ; 100/110 volts, ½ H.P. ; 1 H.P., 1½ H.P., and 16 A.C. Motors.—E. P. ALLAM & Co., 107, Gray's Inn Road, W.C. 1. 2094

FOR Sale, reliable Motor-Generator, D.C., 100 volts to 6 volts output, 105 watts, with switchboard for charging accumulators ; also one accumulator switchboard, complete for 200-volt battery.—BUCHANAN & CURWEN, 36, Baldwin Street, Bristol. 5115

FOR Sale, six marine-type dry-back Boilers, 13 ft. × 11 ft. ; 180 lbs. working pressure.—Box M 924, c/o Dawson's, 121, Cannon Street, E.C. 4. 2071

(Continued on next page.)

FOR SALE.—*Continued.*

FOR Sale, Wheatstone Bridge, by Reed Bros. In first-class condition. Size 9″ × 4½″. Also Galvanometer, 5½′ base, 4″ height, with depression key and zero adjustment.—5074, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, 120-H.P. D.C. Motor by the G.E.C., shunt wound, 500 volts, 650 R.P.M.; now fixed. Immediate delivery.—WILLIAMS & SONS, 37, Queen Victoria Street, London. Telephone, City 3938. 1994

FOR Sale, 500-KW. Parsons Turbo-Alternator, three-phase, 2500 volts. Seen working.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 1995

LAMP Caps on sale.—50,000 selected metal filament Lamp Caps suitable for re-manufacture.—HAMPSONS, 141, Higher Cambridge Street, Manchester. 4929

MOTOR-Generator, 200/20 volts, 70 v., 80 amperes, suit linemen. —THE FARAD ELECTRICAL CO., LTD., Farad House, West Hill, Wandsworth. 5094

ONE gross 5-amp. Bow Cut-outs, 2-H.P. Motor Starter, Speed Regulator, B.T.H. Electroliers.—WILKIN, 27, Hare Street, Woolwich, S.E. 18. 5137

ONE 1-H.P., 220-volt, D.C. Aston enclosed geared Motor, 1650 and 275 revs., new, complete with gear guard and slide-rails. One Automatic N.C.S. Battery, cut-in and out switch, 30 amps., 40 volts. One Venner Time Switch, 10 amps., 45-day clock, two motions. One Aron Motor Meter, house service, slot type, 5 amps., 220 volts, D.C.; one Westinghouse Service Meter, 2·5 amp., 235 volts, D.C., both new.—5134, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ONE 12-H.P. Crypto and one 8-H.P. Fullers 200-volt, 50 ~, slip-ring Motors, with pulleys and starters, also large number of direct current Motors.—Particulars from C. J. FERGUSON, 54, Chiswell Street, E.C. 2096

ONE 200-KW. Steam Generating Set for immediate sale, Willans-Mather & Platt, 220 or 440 volts. Perfect working condition.—JENNINGS, West Walls, Newcastle-on-Tyne. 1513

PLATING Dynamos, 50, 100, 200, 2500, 3600, 15,000 amps.—5125, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

STARTERS, cast-iron, protected, 12½ and 15 H.P., £2 14s.; 8 and 10 H.P., £2 8s. 6d.; 200 to 250 volts, double automatic, substantial design.—5131. ELECTRICAL REVIEW, 4, Ludgate Hill, London.

THREE Igranic self-acting Starting Rheostats, for 500-volt D.C. Motors up to 10 H.P. Suit pumps, printing machines, lift compressors, &c. Condition perfect.—DRUMMOND & CO., Middlesbrough. 2125

THREE 8-H.P., 220-volt, brand new, shunt-protected Motors, 1600 revs.; just unpacked.—DRUMMOND & CO., Middlesbrough. 2126

TWO 250-KW. Belliss Alternator Sets, each comprising a Compound Enclosed Engine, with E.C.C. Alternator, 3000 volts, 50 periods; quite modern, and for immediate delivery.—HARRY H. GARDAM & CO., LTD., Staines. 1852

VERTICAL Boiler, 5′ × 3,′ with vertical high-speed marine Engine, reversible; 6″ Cylinder, make-good Electric Set, coupled to dynamo. Sell cheap,—5130, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

10-H.P., two-phase, 200-volt, 50-period Motor, complete, £45; also 6, 20, 25, 30-H.P. ditto. Single-phase Motors, ½ to 10 H.P., 100/200 volts. Three-phase Motors, 3/6F H.P., 220/440 volts. Seven 190-H.P., three-phase, 550-volt, 50-period Motors.—5127, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

15-H.P., 480-volt, series-wound Crane Motor, by Westinghouse; also one 16-H.P., totally enclosed, by B.T.H. Seen running. —DRUMMOND & CO., Middlesbrough. 2127

18-H.P., 440-volt, compound-wound, enclosed ventilated Motor, 1100 revs. Perfect order.—DRUMMOND & CO., Middlesbrough. 2128

25-H.P., 3-phase slip-ring Motor, by Siemens, 440 volts, 60 cycles, with short-circuiting device; also complete starting gear.—DRUMMOND & CO., Middlesbrough. 5054

37/14S and 37/16s lead-cased armoured Cable, about 400 yards, for sale cheap.—5010, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

44-KW., 110-volt D.C. Generator, compound wound, three-bearing type, with rope pulley and slide rails; speed, 600. —DRUMMOND & CO., Middlesbrough. 5112

70-VOLT, 300-amp. Bipolar, Compound-wound Dynamo, by Holmes; speed, 900; perfect order.—DRUMMOND & CO., Middlesbrough. 5111

FOR SALE.—*Continued.*

100-KW., 220/240-volt, 6-pole Generator, compound interpole 3-boring type. Perfect order. — DRUMMOND & CO., Middlesbrough. 5053

110 VOLTS, 50 amp., two-pole, A.E.C. Dynamo, in good condition.—J. D. CHAMBERS, Central Electric Supply, Newark. 5081

500-KW. Steam Set, comprising triple-expansion enclosed engine, coupled to Westinghouse multipolar generator, 440/490 volts, D.C. For prompt delivery.—HARRY H. GARDAM AND CO., LTD., Staines. 1413

500-KW. Steam Generating Set, comprising a Belliss triple-expansion engine, coupled to an alternator by the Electric Construction Co., Wolverhampton, 3000 volts, 50 periods, with Wheeler-Worthington independent surface condensing plant; modern plant in first-class condition, and for immediate delivery. —HARRY H. GARDAM & CO., LTD., Staines. 1851

ARTICLES WANTED.

DIRECT AND ALTERNATING CURRENT MOTORS.

ADVERTISER will be glad to hear from anyone having any stock of these for 230 or 440 volts.

They must be new machines and in first-class order, and should be complete with necessary belt pulley, slide rail and suitable starter.

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ACCUMULATORS wanted for refining purposes. Obsolete Generating Sets, Dynamos, Motors, and all kinds of Machinery. Scrap Cable, Arc Lamps, Meters, Metal Residues, and Scrap Metals of every description purchased for prompt cash, town or country.—Apply A. BROWN & SONS, 142, Lower Clapton Road, London, N.E. Telephone: Dalston, 555. Telegrams: Secondhand, Lowclap, London. Established 1860. 4358

A.C. and D.C. Motors (second-hand), any type, any condition, wanted for prompt cash.—A. LEAROYD & SON, Bridge Works, Heatherley Street, Clapton, N.E. 4765

A. LEAROYD & SON, Bridge Works, Clapton, N.E.—Telephone Dalston, 2278; Telegrams: Frangible, Lowclap, London—buys for prompt cash every description of second-hand Generating Sets, Accumulators, Motors, Transformers, old Arc Lamps, Meters, Cable, Scrap Metals, Metallic Drosses, &c., &c. Enquiries solicited. Established over 50 years. 4766

ADVERTISER requires old set of Accumulator Battery; any condition would suit.—2095, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

A1 CASH Prices given for Electric Cable, Flexible Wire, Electrical Accessories, &c.—Apply DAVIS, 11, Sun Street, E.C. 2. 1424

ALL for Munition purposes.—Obsolete Motors, Dynamos, Insulated Cable, and every description of Electrical Plant bought to break up. Send us your stocks of scrap metals.—G. H. CHAPPELL SONS & CO., Midland Wharves, Lea Bridge Road, Leyton, N.E. 'Phone:—Walthamstow 500. Estab. 40 years. 4707

BATTERY of 27 cells wanted, capacity about 240 ampere-hours at 10-hour rate.—Give full particulars as to make, date of installation, and where can be inspected, to 2104, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

COUNTRY House Plant, gas or paraffin engine, dynamo, batteries, switchboard. — 2076, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DUDDELL High Frequency Alternator required for use up to 2000 cycles per second. Say where it can be seen, also price.—5038, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMOS, Motors, Arc Lamps, Meters, Scrap Cable, Iron, Metals or Machinery purchased for cash in any quantities.—J. HYAMS, 11, Glengall Terrace, Old Kent Road, S.E. Telephone: 3339 Hop. 4505

HAUSE Dynamo Lighting Set, 4 KW. capacity or near. Engine must be petrol-paraffin. Set with accumulators preferred but not essential.—PORTHOLME, St. John Street, Huntingdon. 2058

(Continued on next page.)

ARTICLES WANTED.—*Continued.*

MEGGER, D.C. voltmeter, ammeter, millivoltmeter.—5088, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

OLD Cable urgently required, also Lamp Tops.—WALLACE, Cromwell House, High Holborn. 4114

OLD Electric Lamps with glass intact.—104, Craven Park, London, N.W. 10. 5049

PLATINUM, in any form and quantity, purchased at highest prices by DERBY & Co., LTD., 44, Clerkenwell Road, London.

PLATINUM Scrap purchased in large or small quantities. Highest market value given.—Before selling elsewhere call or post to the old and reliable firm, THE DEPÔT, 156, Charing Cross Road, London. Established 1850. 5002

STEEL Tubes, all sorts, wanted; Lampholders and Metal and Cardboard Shades; Gas Lighters, Static Electric; Screws, round head, and Hexagon Nuts.—DUGDILLS, Failsworth, Manchester. 5052

THREE-phase induction Motor, slip-ring type, 150 B.H.P., 2,000 volts, 365 revolutions per minute, periodicity 50; one similar but of 100 B.H.P., 290 revolutions per minute; two similar but of 50 B.H.P., 365 revolutions per minute, with four oil switches, 100 amp., 2,000 volts each, with four oil liquid starters; four above, and two oil switches for 200 amp., 2,000 volts for transformer house, immediate shipment essential. Priority certificate not available. Lowest prices and best export terms wanted.—2072, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TWO Motor Dynamos, 30 and 40-H.P., 500 V.—STEWART'S MILLS, Boyle, Ireland. 5123

WANTED, a few 400-volt, 50-cycle, 3-phase Motors, preferably slip-ring type, 5 to 35 H.P.—8133, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, complete plant, petrol or paraffin, Engine and Dynamo Set, with Switchboard, no battery required, 50/65 volts, 50/60 amperes, must be in perfect order.—5090, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Dynamo, 15 volts, 15 amps., D.C., compound; also ditto, 70 volts, 70 amps.; also Motor, 200 volts, 80 periods, single-phase, 30—40 amps.—DEANS, Christopher Road, Leeds. 2078

WANTED, for direct-coupling to high-speed steam engine, 500 revolutions, 30/40 KW. Generator, any standard voltage, but preferably 220 D.C.—Reply, stating maker, price and full details, to 1639, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED immediately, one 50/60-H.P., compound-wound, D.C. Motor, 440 V., with starter; one 30-H.P. A.C. Slip-ring Motor, 440 V., A.C., 50 cycles, 720 R.P.M.; one Cabinet Vacuum Cleaner, 250 V., 50 cycles; also Workman's Time Recorder.—THE NUNEATON ELECTRICAL CONTRACTING CO., Nuneaton. 5066

WANTED immediately, 54-cell Batteries, in glass boxes; 500 and 200 amp.-hour sizes. State age, make, locality and lowest price on rail.—KEATINGE & GAULE, Waterford. 5087

WANTED, Motors and Dynamos, Ammeters, Voltmeters, Megger, Ohmmeter and Generator, Wheatstone Bridge.—5129, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, one shunt or compound-wound Dynamo, 220—230 volts, 500 to 600 R.P.M., about 100 KW.—2081, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, three miles Aerial Cable, about 19/16 or under, bare or covered.—STEWART'S MILLS, Boyle, Ireland. 5096

WANTED, to hire or purchase, a few 200/220-volt, 50 or 70-cycle, single-phase Motors, with starting switches; sizes, 2 to 6 H.P.—Particulars to ENGINEER, Electricity Works, Redditch. 2120

WANTED, two A.C. Motors, 110 volts, 60 periodicity, 20/30 H.P., single phase.—Particulars to CRYSELCO LIMITED, Kempston Works, Bedford. 1826

WANTED, two 50-H.P. and one 12/16-H.P., 440-volt, 3-phase, 25-cycle, 500/750 revs. Motor, slip-ring type with short-circuiting gear and liquid starter; also one 6/8-H.P. Squirrel-cage Motor, with starter, 700/1000 revs.—1967, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, vertical compound high-speed Engine, 80/100 H.P., enclosed, self-lubricating type, by well-known maker preferred. Send price and full details, to 1638, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, ½ or ¼-H.P., 230-volt, 50-cycle Motor. Also 200/220-volt Motor, from ½ to 1-H.P. D.C.—2068, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, 5 to 7-H.P. 550-volt Shunt or Compound-wound Motor, together with starting switch and resistance.—Particulars to THE MANX ELECTRIC RAILWAY CO., LTD., Douglas, I.O.M. 2055

ARTICLES WANTED.—*Continued.*

WANTED, 100/250-KW. Vertical Gas Engine, with 220 volts Generator preferred.—1997, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, 150-KW., 220-V. Generating Set: 30′ × 8′ Boiler 5-ton Travelling Crane, electric preferred; two 50-H.P., 220-volt Motors.—MARTINS, 320, Witton Road, Birmingham. 5103

WANTED, 500 to 1,000-KW. Turbo or Reciprocating Set, 2,200 volts, 25 periods, complete with condensing plant.—1950, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WE often have enquiries from consumers for second-hand 25-cycle, 3-phase, 440 and 2,200-volt motors. Sellers should send post-card, stating horse-power, age, maker, speed, voltage, squirrel or slip ring, pulley diameter and width, and best price, f.o.r.—MOTOR DEPARTMENT, South Wales Electrical Power Co., Royal Chambers, Park Place, Cardiff. 4624

20-H.P. Gas Engine (town gas) in thorough working order. Full particulars and price.—TREDEGARS LTD., 7, Brook Street, W. 5110

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'Phone: GERRARD 2681.

NOTICES RELATING TO PATENTS.

Latest time for receiving 9.30 a.m. Thursday.

John E. Raworth,

Queen Anne's Chambers, 28, The Broadway, Westminster, S.W.1. **Chartered Patent Agent.**

OFFICIAL NOTICES.

Latest time for receiving 9.30 a.m. Thursday.

CITY OF BELFAST.

Electricity Department.

THE Belfast Corporation invite tenders for the manufacture, delivery, and erection in Belfast of the under-mentioned plant, viz.:—

Section "A."
- (*a*) Two 6,000-KW. Turbo-alternators, &c.
- (*b*) One 500-KW. Turbo-generator, &c.
- (*c*) One 30-KW. Balancer-booster, &c.

Section "B."
- (*a*) Four 48,000 lb. per hour water-tube Boilers, &c.
- (*b*) Four Fuel Economisers, &c.
- (*c*) Two steel Chimneys, with fans, &c.

Section "C."
Two electrically-driven boiler-feed Pumps, &c.

Section "D."
Accumulators.

Section "E."
Three 500-KW. and five 1,000-KW. Rotary Converters, with transformers, &c.

Section "F."
Two 250-K.V.A., two 350-K.V.A., and six 1,250-K.V.A. Static Transformers.

Tenders will be considered for either of the main sections or for either of the sub-sections.

The specifications and other particulars may be obtained on application either to Messrs. Preece, Cardew, Snell & Rider, 8, Queen Anne's Gate, Westminster, S.W. 1, or to Mr. T. W. Bloxam, M.I.E.E., City Electrical Engineer, Belfast.

Tenders, upon the presented forms, must be lodged in the Town Clerk's Office, City Hall, Belfast, not later than 16th AUGUST, 1918.

The lowest or any tender will not necessarily be accepted.

An official receipt must be obtained for every tender delivered by hand. Tenders sent by post must be registered.

R. MEYER,
Town Clerk. 2065

TENDERS.

THE Commissioners of His Majesty's Works, &c., are prepared to receive tenders before 11 a.m. on TUESDAY, the 30th JULY, 1918, addressed to the Secretary, H.M. Office of Works, Storey's Gate, London S.W. 1., for the supply of Carbon Filament Tubular Lamps.

Forms of tender, &c., may be obtained on application to the Controller of Supplies, H.M. Office of Works, &c., King Charles Street, Westminster, London, S.W. 1. 2091

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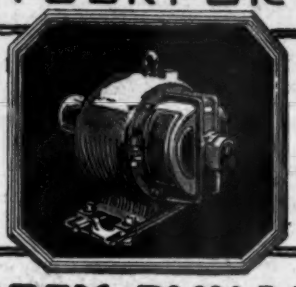

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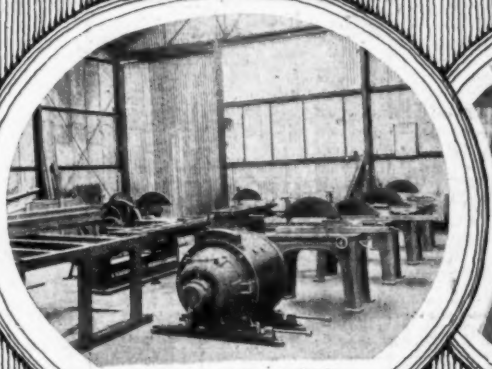

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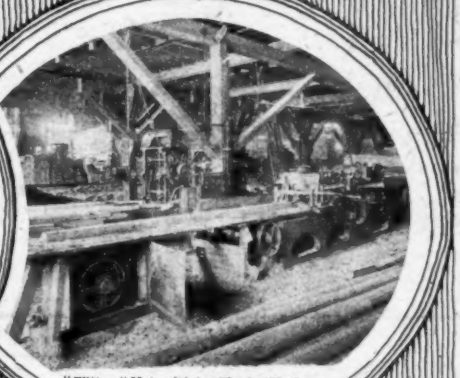

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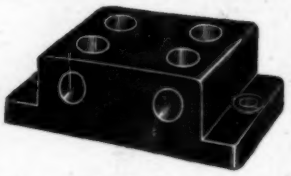

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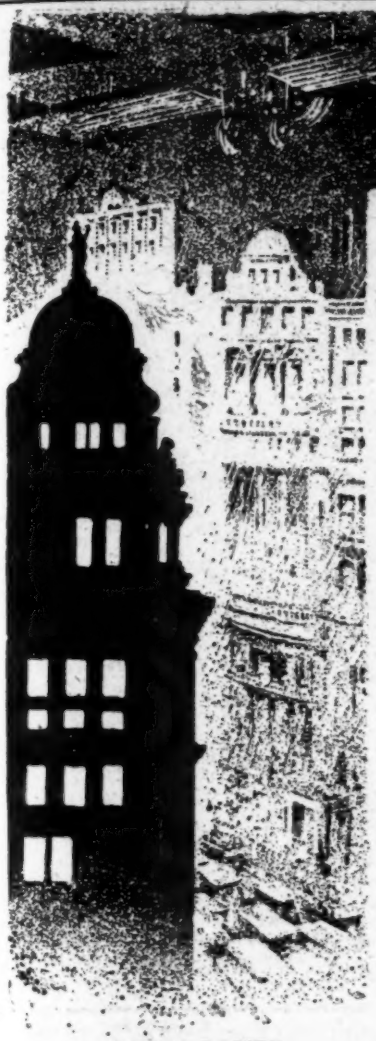

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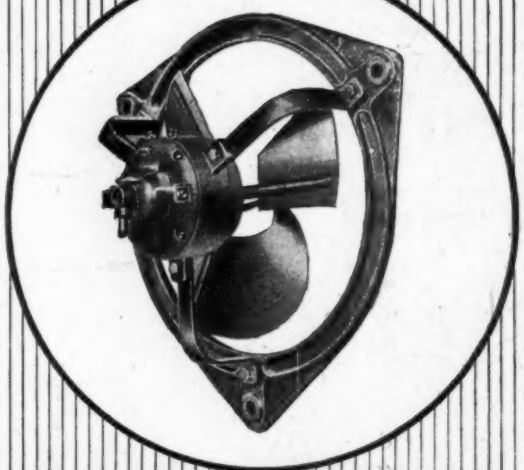

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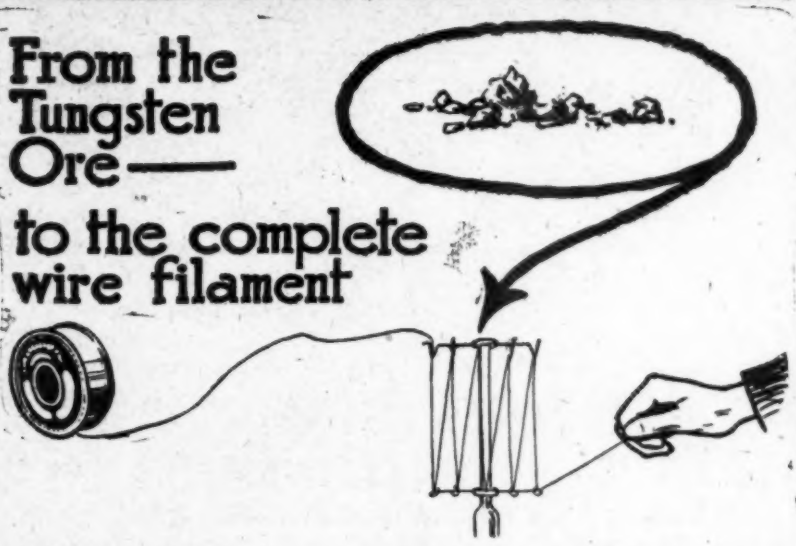

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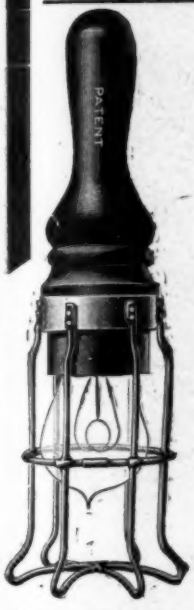

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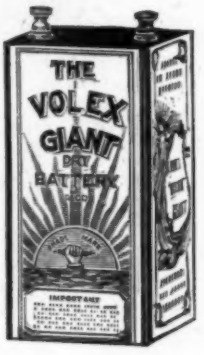

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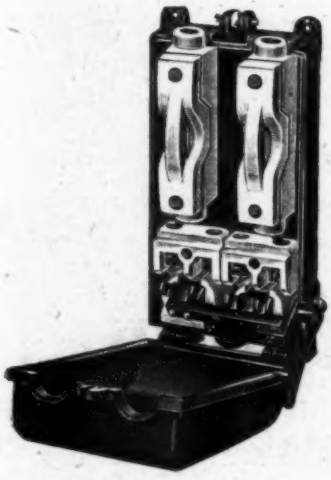

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(Extract from a Paper read on 14th July, 1917, by Mr. H. A. Howie, A.M.I.E.E., A.M.I.Mech. E., Engineer and Manager of the Walsall Electric Supply Department.)

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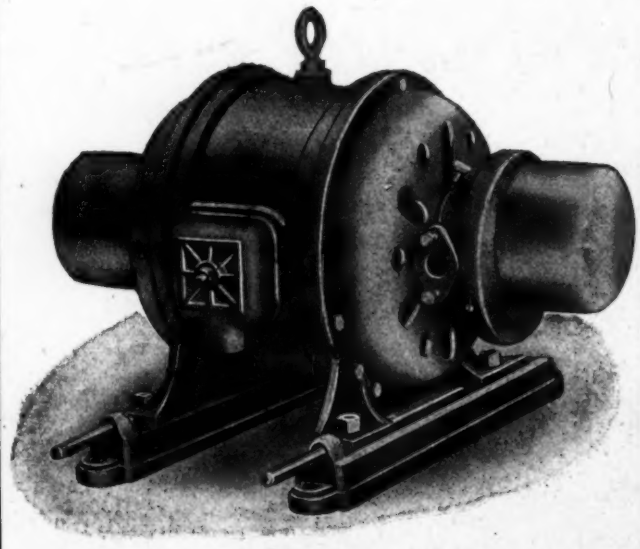

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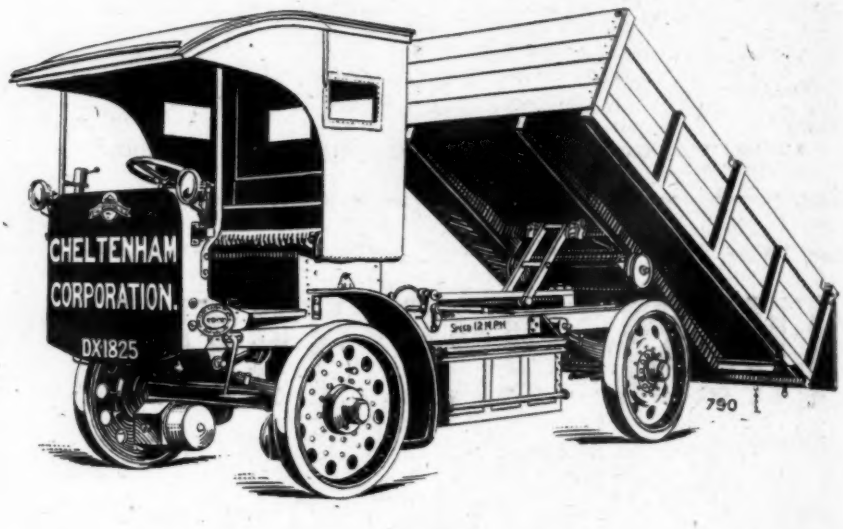

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was £11,363. Passengers carried numbered 153,506,213, an increase of 10,954,666; car-miles run were 9,761,994; traffic revenue, £595,080, an increase of £76,857; passengers carried per car-mile, 15·73, an increase of 0·97; revenue per car-mile, 14·63d., an increase of 1·74d.

Southport.—The T.C. has applied to the B. of T. for an extension of time until August 15th, 1919, for the completion of the electrification of its tramway system.

Sunderland.—ANNUAL REPORT.—The report of the Corporation tramway undertaking for the year ending March 31st shows a gross capital expenditure of £307,120; total revenue, £98,677; traffic revenue, £97,877, an increase of £12,697; working expenses, £57,653, leaving, after the payment of interest and sinking fund, a net balance of £20,204. The total car-miles run were 1,425,007, a decrease of 38,274 miles; passengers carried numbered 25,041,160, an increase of 3,329,671. Price paid per unit, 1·5d.; total units used, 1,975,539, or 1·38 units per car-mile. Revenue per car-mile, 16·48d.; working expenses per car-mile, including power, 9·7d.; excluding power, 7·6d. The sinking fund amounted to £169,959, while that for reserve was £117,832, and that applied to reduction of rates was £67,027.

Women Drivers.—It is stated that the Ministry of National Service and the Trade Unions concerned are conferring on the subject of employing women as tramcar drivers.

TELEGRAPH AND TELEPHONE NOTES.

Broken Insulators.—At Croston, last week, when two boys were each fined 15s. for attempting to damage telegraph insulators, it was stated that 600 insulators had been broken in that area alone, the damage being £105. During the last two years there had been 25 prosecutions.

Canada.—The telegraph operators of the Great North-Western Railway have threatened to strike, but it is hoped that the strike will be averted.

South America.—According to *The Times*, important developments are in progress in connection with the wireless service. Last year the Pan-American Wireless Telegraph and Telephone Co. was formed, comprising the American and English Marconi Companies and the Federal Holdings Co., which had a concession from the Argentine Government for wireless communication with New York. The last-named company has now been bought out by the U.S. Government, and the Pan-American Co. has secured an amplified concession for world-wide wireless communication with the Argentine. The Marconi Co. has a similar concession, and had begun to erect the plant when war broke out, and the work was suspended.

United States.—The Senate has passed a measure giving the Government authority to take over the telegraphs and telephones of the United States during the war.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—September 4th. Victorian Railway Commissioners. 800 lighting transformers for signal system. A copy of the specification may be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence) in London.

Belfast.—August 16th. Corporation. Two 6,000-KW. turbo-alternators, &c.; one 500-KW. turbo-alternator, &c.; one 30-KW. balancer-booster; four 48,000-lb. per hour water-tube boilers; four fuel economisers, &c.; two steel chimneys, with fans, &c.: two electrically-driven boiler feed pumps, &c.; accumulators; three 500-KW., and five 1,000-KW. rotary converters, with transformers, &c.; two 250-K.V.A., two 350-K.V.A., and six 1,250-K.V.A. transformers. See "Official Notices" to-day.

Gillingham.—July 22nd. B.C. One 640-B.H.P. combined Diesel engine and alternator. See "Official Notices" July 12th.

London.—OFFICE OF WORKS.—July 30th. Carbon-filament tubular lamps. See "Official Notices" to-day.

Spain.—MADRID.—The Dirección de Telégrafos invites tenders for the supply of 70 tons of galvanised steel wire of 4 mm. diameter, and 30 tons of 3 mm., for use in the construction of a telegraph line between Barcelona and Valencia.—*Gaceta de Madrid*.

OUR HALF-YEARLY INDEX.

As it is necessary to effect every possible economy in paper consumption, the Index to Vol. 82 of the ELECTRICAL REVIEW, which has now been printed, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d., post free. Any reader or advertiser at Home or Abroad, who requires a copy for binding, or for other purposes, is asked to make application therefor promptly to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Disabled Soldiers.—The April issue of *Recalled to Life*, a journal devoted to "the care, re-education, and return to civil life of disabled sailors and soldiers," contains articles written by men who are seeking for practical solutions of the problems presented by disabled soldiers—problems which are both medical and sociological. Half of the men who are wounded require special treatment for the restoration of movement to damaged limbs. Great military hospitals have been, and are being, established in various centres throughout the country for the treatment of these orthopædic cases. Success in the treatment of orthopædic cases is largely a problem of education—to teach soldiers how to bring back lost movements to damaged joints by voluntary and natural movements of the limbs. The introduction of "curative workshops" to military hospitals is one of the most profitable innovations of the war. Of the men treated in orthopædic hospitals about three-fourths return again to military service; the remaining fourth is discharged as unfit for further service. It is now the business of the Ministry of Pensions to look after the welfare of that discharged fourth. Various writers describe the organisations which are being brought into existence to meet the needs, not only of the men discharged from orthopædic hospitals, but also of the large numbers rejected by the Army on account of a permanent breakdown in health due to exposure in the field. Everywhere the importance of "self-help" is emphasised.—*Nature*.

Air-Raid Signalling Sirens.—In *Engineering*, July 5th, illustrations are given of the Chollet rotating vanes and the series of horns forming the sirens which are mounted on the monuments of numerous French towns to warn the population of the approach of enemy aircraft. The siren consists of a casing, or stator, inside which revolves an aluminium rotor mounted on a shaft provided with ball bearings. The stator has a number of openings, generally rectangular, whilst the rotor has also a number of openings of the same shape. Vanes for canalising the air start from the centre of the rotor and end at the rotor openings. When the rotor revolves, centrifugal force drives the air from the rotor towards the openings and through the openings cut in the stator. The flow of air is thus alternately permitted and interrupted, each opening in the rotor driving air through each opening in the stator in succession. Hence the vibrations of the system vary in number with the number of openings of the rotor. The rotor is actuated by means of an electric motor coupled to the rotor shaft, the system being operated at a distance by means of switches; starting rheostats are used for the large types, which require from 12 to 15 H.P.

In order to amplify the sounds, conical horns of suitable shape and length are connected to each opening in the stator. The Paris sirens have a total weight of 800 kg. (about 1,700 lb.); their aluminium rotor is 0·5 m. (19·5 in.) in diameter, the horns being 2 m. (6 ft. 6 in.) in length and 0·5 m. in diameter at their mouth. In the open, they can be heard at a distance of 8 to 10 kilometres (about 6 miles), but in Paris, owing to the noise in the town, the range does not exceed a radius of 1·5 kilometres (just under 1 mile).

In one type of Chollet siren, all the sound waves are sent in one and the same direction. In this type, the siren is fitted at the bottom of a megaphone horn. There are sirens of this type in which the horn has a length of 3 m. (9 ft. 10 in.) and a diameter of 1·5 m. (4 ft. 11 in.) at the mouth; they weigh each about 1 ton, and the rotor, which is operated by a 10-H.P. electric motor, has a diameter of 0·5 m. (19·5 in.) at the mouth.

Hand-operated sirens have also been built in large numbers, but their range of sound covers a radius of 400 to 500 m. (about 540 yards) only.

Coal by Thermometer.—According to the *Times*, in view of the threatened coal shortage next winter, householders in the United States will be allowed only as much coal as is scientifically necessary to heat the house to a temperature of 68° F. This statement might inspire the imagination to picture an engineer with a squad of assistants and a score of thermometers, carrying out thermal efficiency tests on the grates and chimneys of the houses concerned, or the central heating apparatus of the establishment, in various conditions of weather. We look forward to the compilation of really reliable data on house-warming in the U.S.A.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending July 27th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. W. Darley Bentley.

Next for Duty.—Capt. E. G. Fleming.

Sunday, July 21st.—Commandant's Parade at Waterloo Station, 8.45 a.m. for work at Esher. Dress: Drill order, with haversacks and waterbots. Mid-day and tea rations to be carried.

Monday, July 22nd.—Adjutant's Technical Lecture ("Earthworks"), 6.30—7.30 p.m.

Thursday, July 25th.—General Meeting of the whole Corps, 6.30 p.m.

Friday, July 26th.—Adjutant's Technical Lecture ("Earthworks"), 6.30—7.30 p.m.

Saturday, July 27th.—Engineering Reconnaissance Scheme for Officers, at Esher.

The Annual Camp will be held at Esher from August 3rd to August 11th, both days inclusive. During this period Headquarters will be transferred to Sandown Park, Esher.

C. HIGGINS, *Capt.*, R.E., *Adjutant.*

Tariffs for Interconnected Three-Phase Generating Stations.—It is obvious that the conditions governing the reciprocal payments for energy supply between two separate generating stations feeding an interconnected network call for special forms of tariff. Such tariffs should be made to depend greatly on the power factor of the load supplied. The maintenance of high values of the power factor is important. The calculation of certain special cases of distribution systems connected to two separate generating stations shows that under certain circumstances a very small change of the excitation of the machines may alter the direction of the supply of power between the two stations. On this account reverse-current relays may be caused to operate if the excitations of the two stations are not carefully regulated in correspondence. The conditions of such reversals are made clear, and it is shown how in the case of the Rhenisch-Westfälisches Elektrizitätswerk the maintenance of high power factor and accurate control of the direction of flow of the current between its constituent stations are encouraged by the adoption of a special tariff. This tariff is rendered possible by the use of a wattless energy meter.

The difference between the readings of an ordinary watt-hour meter and a wattless energy meter is taken as the basis of a credit and debit in the calculation of the charge to be borne by a particular generating station. Leading and lagging currents have very different effects on the cost of generating power, and the energy supplied under these two conditions may be separated, either by using two wattless energy meters in opposition with stops to prevent them from running backwards, or by using a single meter with two separate counting trains. With stations running in parallel the energy may be delivered in either direction, and the wattless energy meters must be put out of action when the current reverses, special meters being installed to register when this takes place. A diagram shows the installation of two ordinary watt-hour meters, together with four wattless energy meters provided with two reverse-current relays to separate the wattless energy delivered in either direction and with leading or lagging current. If frequent changes in the direction of the supply of power do not take place, the number of meters can be halved.

A special tariff has been drawn up in connection with the reciprocal arrangement between the two generating stations on the system referred to. If A is the number of wattless units to be debited or credited, K the number of actual units, N the number of wattless units delivered at lagging power factor, and V the number of wattless units delivered at leading power factor, then for each station the following relation is taken:—$A = N - V - K$.

If A is negative, the supplier is debited with this number of units at 0·5 pf. per wattless unit, and the consumer is credited with 0·25 pf. for that number of units. On the other hand, if A is positive the supplier is credited with 0·25 pf. per wattless unit, and the consumer debited with 0·5 pf. for that number of units. This tariff is graphically illustrated. The meters are so adjusted that the difference in the readings of the lagging and leading wattless energy meters is equal to the reading of the meter recording the actual energy consumption, if the electrical energy is supplied at an average power factor of 0·7.

Several meters have been constructed for the purpose of this tariff. In one type illustrated the meter contains two armatures, each of which can register on one of two counting trains according as the current is leading or lagging. The two meters are interconnected by differential gearing, which registers amounts to be credited or debited on two separate counting trains. In another form of the meter one armature is used, which records credits and debits on two different counting trains, according to its direction of rotation.—*E.T.Z.*, March 7th and 14th.

London Lectures on Reconstruction.—The Industrial Reconstruction Council has arranged for a series of lectures to be held at the Sadlers' Hall, Cheapside, in October, November, and December next, on Wednesday afternoons, at 4.30 p.m.:—

October 2nd.—Sir Albert Stanley, M.P. (President of the Board of Trade), "Commerce and Industry After the War."
October 16th.—Right Hon. Christopher Addison, M.D., M.P. (Minister of Reconstruction), "Principles of Reconstruction."
October 30th.—Mr. W. L. Hichens (managing director, Cammell, Laird and Co.), "Functions of the Government in Relation to Industry."
November 13th.—Sir Arthur Steel-Maitland, Bart., M.P. (Department of Overseas Trade), "International Trade."
November 27th.—Mr. Ernest J. P. Benn (Chairman, Industrial Reconstruction Council), "Labour and Industrial Development."
December 11th.—Sir William S. McCormick, LL.D. (Department of Industrial and Scientific Research), "Science and Industry."

A full prospectus of the series may be obtained from the Secretary, I.R.C., 2 and 4, Tudor Street, E.C. 4.

Electrical Power Engineers' Association.—As a result of the meeting held in Glasgow, on June 29th, members of the staffs of the electricity supply undertakings of the following Scottish towns have now joined the movement—viz., Glasgow, Greenock, Perth, Dundee, Kilmarnock, and Motherwell.

Eligible members can obtain information from Mr. J. H. Wright, 8, Garland Place, Dundee, Interim Publicity Secretary for Scotland, E.P.E.A.

Electrical Research Committee.—The Electrical Research Committee, which was appointed last autumn under the auspices of the Department of Scientific and Industrial Research, is at present engaged in superintending a research on insulating materials (fibrous materials, porcelain, ebonite, mica, composite materials), and the water-proofing treatment of insulating windings of electrical machines, in respect of which grants have been made to the Committee by the Research Department, the B.E.A.M.A., and the Institution of Electrical Engineers.

The Committee consists of three members nominated by the Institution of Electrical Engineers and three members nominated by the British Electrical and Allied Manufacturers' Association, the nominees of the former being Mr. C. H. Wordingham, C.B.E. (chairman of the Committee), Mr. C. C. Paterson, O.B.E., and Mr. C. P. Sparks; and those of the latter, Mr. F. R. Davenport, Mr. D. N. Dunlop, and Mr. A. R. Everest.

The temporary address of the Committee is No. 1, Albemarle Street, London, W. 1, and its Secretary is Mr. P. F. Rowell.

Charges for Public Services.—A meeting of representatives of public utility undertakings, comprising gas, electricity, tramways, and water supply, was held on Monday last, to consider the proposals of the Statutory Undertakings (Temporary Increase of Charges) Bill. It was agreed that the Bill's proposals were wholly inadequate to meet the case. The companies could not possibly fulfil their obligations to the public unless they were empowered to pay a sufficient rate of interest to attract the necessary capital, and so raise money for the important developments which would be necessary to the country after the war.—*Daily News.*

The Employment of Women at Night in Electricity Works.—We are informed that the Home Secretary has recently had under review the question of the employment of women at night in electrical generating stations and sub-stations. As the work is usually carried on continuously day and night by a system of 8-hour shifts, and as the employment of women at night is illegal under the Factory Act unless it is specially authorised by the Secretary of State, he thinks it desirable to remind authorities of electrical stations that special application must be made to the Home Office (through the District Inspector of Factories) before any women are employed on a day and night shift system. The authorities of some stations appear to be unaware of this, and have employed women at night without authority.

A certain number of orders have been made during the war, under the above-mentioned provisions, to permit the employment of women at night, or for other special hours, in electrical generating stations and sub-stations, but in view of the special suitability of the work for discharged soldiers and sailors, and of the fact that the employment of women at night must in any case cease with the end of the war, the Secretary of State considers it very desirable that so far as possible vacancies should be filled by the employment of discharged men—carefully selected and suitably trained—in preference to women. Disabled men are being trained for electrical sub-station work at several schools and centres in the large towns, but if no trained men should be available the local Employment Exchange, to which all applications should be made, may be able to supply disabled men to be trained at the works. The Secretary of State has accordingly decided, after consultation with the Minister of Labour, not to grant any fresh orders to allow the employment of women, unless he is satisfied that a *bonâ-fide* attempt has been made to employ disabled men. This decision does not apply to stations or sub-stations at which the employment of women for special hours has already been authorised; in such cases the Secretary of State is prepared, if necessary, to continue the permission during the war.

In connection with the employment of fresh labour new to the work of electrical stations and sub-stations, the Secretary of State desires to call attention to the requirements of No. 28 of the Home Office Regulations under the Factory Act. While such persons, if carefully selected, can be adequately trained within a comparatively short time to do the routine work of an electrical station, they must not, without a longer and more thorough training, be allowed to undertake the class of work indicated in the second part of the first paragraph of the regulation—which includes cleaning of, or near, live apparatus, *e.g.*, switchboards—where technical knowledge or experience is required in order to avoid danger. They may, however, if necessary, be allowed to undertake the cleaning of the fronts (only) of medium-pressure switchboards of a simple character, provided (1) that adequate instruction has first been given; (2) that any necessary safety appliances, *e.g.*, insulating gloves and goloshes, are used; and (3) that such cleaning is not done when the person is unaccompanied.

If copies of this notice are required for distribution to electrical station engineers, or others responsible, they will be supplied on request addressed to the Under Secretary of State, Home Office, S.W. 1, quoting the number 198,802/24,238.

Engineers' Leaving Notes.—The introduction of leaving notes in controlled shops is being considered this week by shop stewards and engineering and electrical trade unions throughout the country. Mass meetings of protest have been convened in a number of centres to demand the withdrawal of the notes. The question was again considered in Manchester on Monday night at a meeting of delegates of the Manchester district of the Electrical Trades Union, and it was decided to request the Government to cancel the system of issuing leaving notes.—*Manchester Daily Dispatch.*

Sentence for Stealing.—At the Southampton Police Court, last week, T. W. Donald, electrician, was sentenced to six months' hard labour on a charge of stealing a large number of electric globes and other articles, the property of Messrs. Summers and Payne, by whom he was employed as charge electrician.

South Wales and Monmouthshire Linking-up.—With reference to the report of the Committee on linking-up, on page 562 of our issue of June 14th, we wish to point out that the standards quoted cover Group A (Western District) only, and have no bearing on the findings of the Committee with respect to groups B and C.

Training for ex-Officers.—Lord St. Davids, chairman of the London Executive Committee of the Ex-Officers' Employment Bureau, addressed a meeting of leading commercial men at Newcastle, last week, on the aims of the Bureau, which, he said, was not a charity, but a registry run by employers. Sir Henry Hadow, Principal of Armstrong College, supported the scheme, and said that three things were necessary in the interests of ex-officers who required employment—namely, the Bureau, training, and financial assistance. He hoped that employers would give the utmost support to the registry. Regarding the second point, there must be some organised scheme for training and qualifying those who passed through the registry. The ordinary gratitude of the country called for suitable posts to be found for these men. The Ministry of Labour had approached the Universities on a short-course scheme of training officers, and that would be extended to all persons who had served their country in the Navy, the Army, or the air. At Armstrong College there would be a short course for those desirous of becoming teachers under Mr. Fisher's new scheme. If it could be done in one year, well and good; if not, it would be made two years. That course would be available at Armstrong College next term, in September. Financial help might be necessary in some cases, to enable men to profit by these educational facilities, and it was absolutely necessary for the success of the whole scheme that some public financial assistance should be given where it was needed.—*The Times.*

Starting Motors for Petrol Motor-Cars.—A Sub-Committee of the Accessories Committee of the Society of Motor Manufacturers and Traders is considering the question of standardisation as regards electric engine-starting motors for use on petrol motor-cars. At its last meeting it decided to confine itself to motors, and not to take in the question of dynamos for car lighting purposes. Some discussion took place with regard to cable sizes, and it was agreed to recommend that the motor should be fitted on the engine, and not on the chassis.

A Commercial Library.—The new Commercial and Technical Library opened in the Municipal Buildings at Leeds, by the Corporation, will prove of much use to business men. A careful selection has been made of literature likely to prove useful to the electrical and allied trades. Among the volumes on the shelves is an excellent selection of electrical works, as well as a complete collection of reference works and official patent and other publications intended for the use of the commercial community in the district, and on the general reading tables is a selection of the leading trade periodicals. We cannot too strongly commend this excellent example to other public authorities; too many public libraries are crammed with works of fiction, and the sprinkling of technical books shows a want of knowledge of their respective merits. Librarians would do well to seek the advice of experts in the selection of such works, for it is quite impossible for the layman to make a satisfactory choice from the profusion of technical books on the market. We have urged in these columns that business firms and manufacturers should provide well-stocked technical libraries for the use of their employés; to attain successful results it is essential to *lend* the books for home reading, but a set of reference books for use only on the works premises should be provided, and should be at all times readily accessible to the employés. We are sure that technical men in any locality will always be glad to assist in the selection gratuitously, and may add that we are almost daily called upon to give advice in this respect.

The Wages Conference of Electricity Supply Authorities.—At a recent meeting of the Wages Conference of Local Authorities owning electricity undertakings in Greater London, it was reported that the Executive Committee of the Conference had failed to arrive at an agreement with the Electrical Trades Union, and the whole question would be referred to the Committee on Production for arbitration. The Conference empowered the Executive Committee to employ counsel to act on behalf of the Local Authorities, and called upon each Authority represented on the Conference to contribute £10 towards the cost.

Engineering Scholarship.—A Goldsmid Entrance Scholarship tenable in the Faculty of Engineering at University College, value £30 a year for three years, may be awarded in September. Entry forms must be sent in on or before September 10th.

Gas for Traction.—The Gas Traction Committee (the Petroleum Executive, 12, Berkeley Street, W. 1) announces that the Commissioner of Police of the Metropolis has approved the issue of licences for 20 motor-omnibuses equipped to run on compressed coal-gas, and the necessary authority has been obtained to conduct trials with 20 goods-carrying commercial motor-vehicles equipped to run on compressed coal-gas.

Engineering Trade Unions and Amalgamation.—We read in the *Times* that the A.S.E. has adopted a scheme formulated by a Sub-Committee for a basis of amalgamation of the engineering Trade Unions.

Institution and Lecture Notes.—Association of Mining Electrical Engineers.—Negotiations which have been proceeding for some time between the East and West of Scotland Branches of the Association with the view of inaugurating a new branch for the Lothians area of Scotland materialised on Saturday last, when a joint excursion was arranged to Arniston Colliery, near Edinburgh. After inspection of the electrical plant and other apparatus at the colliery, the visitors were entertained by the directors of the Arniston Coal Co., Ltd. The following officials were afterwards appointed:—President, Mr. Peter Milligan, general manager of the Arniston Coal Co.; vice-presidents, Messrs. J. R. Laird, Bathgate, and Bunting, Edinburgh; secretaries, Messrs. D. Landale Frew, 45, Hope Street, Glasgow; Arthur Robinson, 28, North Bridge, Edinburgh. Excursions have been arranged to the Clyde Valley power station and to the engineering works of Messrs. Bruce Peebles & Co., Edinburgh.

Royal Society of Arts.—Mr. Alan A. Campbell Swinton, F.R.S., has been re-elected chairman of the Council for the ensuing year.

Junior Institution of Engineers.—The July issue of the *Journal* contains the Gustave Canet lecture on "The Stokes Gun," by Sir Wilfrid Stokes, and a biographical sketch of the author, who delivered the lecture on June 24th, with lantern and experimental illustrations.

Appointments Vacant.—Assistant railway telegraph engineer (£400) for the Ceylon Government; mains assistant for the Dover Corporation Electricity Works; junior shift engineer for the Rotherham Corporation Electricity Supply; switchboard attendant for the Barnstaple B.C. Electricity Department; senior (£150 + £52 + 12½ per cent.) and junior (£100 + £52 + 12½ per cent.) draughtsmen for the City of Birmingham Electricity Supply Department; shift engineer for the Stretford U.D.C. Electricity Department; switchboard attendant (60s. + 12½ per cent.) for the Derby Corporation Electricity Supply; chief assistant engineer for the Horsham W.D.C. Electricity Department. See our advertisement pages to-day.

The Marconi Libel Case.—On Tuesday the action for libel brought by Mr. Godfrey Isaacs against Sir Chas. Hobhouse was begun before Mr. Justice Darling. The case is proceeding.

Auction Sale.—Messrs. G. N. Dixon & Co. will sell by auction, at Birkenhead, on August 1st, a valuable electric lighting plant, lamps, carbons, fittings, &c. Full particulars are given in our advertisement pages to-day.

British Electrical and Allied Manufacturers' Association.—We are informed that the following firms have been elected members of this Association:—

Accumulators, Ltd.
Arora Co.
Ashdowns.
Associated Battery Co., Ltd.
Barnard, J. W.
Bastian Electric Co., Ltd.
Belling & Co.
Bluemel Bros., Ltd.
Brompton and Kensington Accessories Co., Ltd.
Cable Accessories Co., Ltd.
Croggon & Co., Ltd.
Curtis Manufacturing Co., Ltd.
Elec. & Engineering Specialities Co.
Fuller Accumulator Co., Ltd.
Griffiths Bros. & Co., London, Ltd.
Jackson Electric Stove Co., Ltd.
Jeal & Co., Ltd.
Lithanode, Ltd.
Lucas, Joseph, Ltd.
New Peto & Radford Accumulator Co., Ltd.
Randall Bros.
Richford & Co., Ltd.
Rotax Motor Accessories Co., Ltd.
Rushmores, Ltd.
Sun Electrical Co., Ltd.
Surrey Electrical Co., Ltd.
C. A. Vandervell & Co., Ltd.
Wiggins, F., & Sons.

An Electrically-Welded Ship.—The first steel vessel with the plates welded together, instead of riveted, has just been launched on the South Coast. It is estimated that a saving of 20 or 25 per cent. in both time and material is effected by this system. The shell is continuously welded, both inside and out, up to the bottom seam of the bilge-plate; "tack" welding, in which about one-third of the length is welded at short intervals, is employed for joints that need not be watertight. The deck-plates are butt welded.

Organisation of Industry.—At a meeting of the Industrial Reconstruction Council, to be held in the hall of the Institute of Journalists, 2 and 4, Tudor Street, E.C. 4, on Wednesday next, at 6 p.m., Mr. Arthur Greenwood, Secretary to the Whitley Committee, will open a discussion on "The Organisation of Industry." Delegates from various Trade Unions and Associations will be present.

Canadian Nickel Plant.—On Dominion Day the large plant of the International Nickel Co., which has been for 20 months under construction, began operations at Port Colborne, Ontario. The plant will produce annually from 20,000,000 lb. to 24,000,000 lb. of refined nickel and 12,000,000 lb. of copper. The plant is so constructed that in case of necessity the production could be quadrupled.—*The Times.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Mr. W. E. PLOWMAN, charge engineer at the Poplar B.C. electricity works, has resigned to take up another appointment.

Mr. A. G. COOPER, electrical engineer to Colne Corporation, having received an appointment on Government work, has resigned the former position, which he has held for over 18 years.

The Ayr Town Council has advanced the salary of the burgh electrical engineer from £400 to £500 per annum.

The Barnstaple Electricity Committee has appointed Mr. ALFRED STONIER, of Newbiggin, Northumberland, as assistant engineer.

The Worcester City Council has resolved to increase the salary of the electrical engineer, Mr. C. M. SHAW, by five annual increments of £50 each, the first commencing as from April 1st, 1918.

General.—The Franklin Institute has awarded the Howard N. Potts medal to Dr. A. GRAY, of Ithaca, N.Y., for his paper, entitled "Modern Dynamo-electric Machinery," which is "an exhaustive discussion of the design of dynamo-electric machinery." An Edward Longstreth medal of merit has been awarded to Dr. J. B. WHITEHEAD, of Baltimore, for his paper, entitled "The Electric Strength of Air and Methods of Measuring High Voltage," which gives "a clear exposition of the underlying principles of the phenomenon of the electric corona at high potentials."

The *Times* says that Sir JOSEPH LARMOR, M.P., has been awarded the Poncelet Prize for the mathematical sciences this year by the French Academy of Sciences.

We understand that Mr. C. S. NORTHCOTE, M.I.E.E., who will be remembered as the deputy-chairman of the Olympia Electrical Exhibition of 1905, also the manager of the Manchester Exhibition, 1908—Mr. Northcote lays emphasis upon the title "CenSatioN" in this connection—is applying for his discharge in bankruptcy, and hopes shortly to resume business as "Wholesale Electric Traders and proprietors of C.S.N.sation patents."

The *Times* announces that Mr. S. F. JAMES, hon. solicitor to the Municipal Tramways Association, has been appointed secretary to the Board of Trade Tramways Committee.

Roll of Honour.—Sapper A. ROBINSON, R.E., who has died of wounds, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Lance-Corporal B. KELLY, Lancashire Fusiliers, who has died of wounds, was an employé of the British Westinghouse Co., Ltd., Trafford Park.

Private EDGAR BERRY, Cheshire Regiment, who has been killed in action, was employed by the St. Helens Cable Co., Warrington.

Private W. BROWN, Loyal North Lancashire Regiment, who has died from pneumonia, following shell shock and gas poisoning, was employed by Messrs. Ferranti, Ltd., Hollinwood.

Second-Lieut. EVAN M. BALFOUR, Scots Guards, who has been awarded the Military Cross for conspicuous gallantry and devotion to duty, was on the staff of the Victoria Falls Electric Supply Co., Johannesburg, where he enlisted for service in the South African Horse under the Transvaal Government. He served throughout the two South African campaigns.

Private JAMES JOBE, N.F., who has been awarded the D.C.M., was an electrician at Elswick.

Sergeant A. NEAL, Rugby Howitzer Battery, formerly engaged at the Rugby works of the B.T.H. Co., has been awarded the Italian Croce di Guerra for gallantry in action.

Private E. HARDISTY, formerly an employé of Messrs. Dixon and Sons, electrical engineers, Leeds, has been posted as missing.

We regret to read in the *Times* that Captain GAUTHIER VILLARS, head of the well-known house of scientific publishers which bears his name, has been killed at the Front while in command of his battery. He was a member of the Legion of Honour, and received the Croix de Guerre. On May 3rd his battery knocked out the long-range gun which bombarded Paris.

Obituary.—MR. I. HOLMES.—The death is reported of Mr. Israel Holmes, of the Keighley Electrical Engineering Co., at the age of seventy-three.

MR. J. MCI. POLLOCK.—The death is notified, at the age of fifty-five years, of Mr. J. McIntosh Pollock, for many years an engineer with Messrs. Elliott Bros., Lewisham.

ALD. J. B. WATSON.—Ald. J. B. Watson, chairman of J. B. Watson & Son, Ltd., sanitary and electrical engineers, of Stockton and Middlesbrough, passed away at Stockton on July 14th. He had been a member of the Corporation for 25 years.

NEW COMPANIES REGISTERED.

Precision Tool Co. (Halifax), Ltd. (150,195).—Private company. Registered July 8th. Capital, £2,000 in £1 shares. To take over the business of tool and jig makers carried on by J. Marsland at Dyson Street, King Cross, Halifax. The subscribers (each with one share) are:—J. Atkinson, 41, Moorfield Villas, Halifax, chartered accountant; A. U. Day, Braeside, Dalton, Huddersfield, engineer; J. R. C. August, Summergate Villa, Parkinson Lane, Halifax, engineer. The first directors are J. Atkinson, A. U. Day, and J. R. C. August. Registered office: 5, Dyson Street, King Cross, Halifax.

Cosmore, Ltd. (150,933).—Private company. Registered July 11th. Capital, £12,000 in £1 shares. To enter into an agreement with A. C. Cossor and W. R. Bullimore, and to carry on the business of manufacturers of oscillation valves and amplifiers for wireless telegraphy and telephony, and all apparatus necessitating low pressure, liquid air, and other liquids of low temperature, tungsten and other targets for scientific and electrical purposes, glass taps and stop-cocks, &c. The subscribers (each with one share) are:—A. C. Cossor, Fawley Cottage, Fawley, Hants, scientific instrument maker; W. R. Bullimore, 5, Museum Mansions, Great Russell Street, W.C. 1, scientific instrument maker. The first directors are: A. C. Cossor and W. R. Bullimore. Registered office: 11, Clerkenwell Green, E.C.

Metallurgical Research Co., Ltd. (150,914).—Private company. Registered July 8th. Capital, £3,000 in £1 shares. Iron, brass, aluminium, and metal founders, manufacturers of and dealers in gold, aluminium and other alloys, refiners of residues, chemists, metallurgists, electro-metallurgists, manufacturers of and dealers in electrical and automobile supplies, &c. The subscribers (each with one share) are: R. H. Cressey, 409, Foleshill Road, Coventry, metallurgical chemist; W. B. Cressey, 409, Foleshill Road, Coventry, engineer; E. Sidwell, Alton Hall, Alton Road, Allesley, Coventry, engineer. Table "A" mainly applies. Solicitor: C. Martin, 18, Hertford Street, Coventry.

CITY NOTES.

British Thomson-Houston Co., Ltd.

Mr. H. C. LEVIS presided at the annual meeting held on Wednesday. He said that the past year had imposed exacting demands upon the employés, and he could not speak too highly of their loyal and efficient co-operation. Of the employés who joined the forces 180 had been killed in action or had died in service; 21 were missing and were believed to have been killed. In addition, 163 had been wounded, 13 were prisoners of war, and one was interned in Holland, making the total list of casualties 378. Of the 121 holding commissions, 87 had been promoted from the ranks; 39 had been awarded special honours; 16 were mentioned in dispatches, and 11 had been specially commended for services in the field. As stated in the last report, the company proposed to erect a suitable memorial to those who had died in serving their country. Mr. C. A. Coffin, one of the directors and chairman of the board of the General Electric Co., of New York, had been awarded by the French Government the Order of Officer of the Legion of Honour, in recognition of his energetic and fruitful work in connection with the French Red Cross and other kindred organisations; and the Serbian Government, for the same reason, had likewise conferred upon him a similar Order for work in connection with Serbia. Another of the directors, Mr. Owen Hugh Smith, for the past three years had given practically his entire time to work for the Ministry of Munitions and also as one of the emissaries from Great Britain to America in connection with food problems. They welcomed as a valuable addition to the board Lord Carmichael. After consultation with the holders of a very large majority of the shares, both ordinary and preferred, the directors did not recommend the payment of dividends. For several years they had heavily depreciated their goodwill, patents, &c., account. After very careful consideration as to the value of the goodwill and patents it had been decided to reinstate this account at its original cost, which they believed was fully justified. They had likewise heavily depreciated the office furniture and fixtures account, and pending a valuation, had reinstated an amount of £20,000, which they believed the valuation at pre-war values would fully substantiate. The total amount written back on those two items was £157,958, and to this they had added from this year's profit £80,000, so that the total capital reserve now stood at £237,958, or substantially the same amount as goodwill, patents, &c. During the year they had expended £71,632 on plant account. The securities which they held in lighting, traction and other companies had been depreciated by £7,465, bringing the total valuation down to £90,000, which was conservative. The profit for the year was £329,664, after making provision for the estimated war taxation for 1917. Provision had also been made for the unsettled balance of munitions levy and excess profits duty for 1916. This profit, together with the balance from last year, make the total amount they had to deal with £343,586. They had on hand at the end of the year Exchequer and National War Bonds to the amount of £175,000. It would be interesting if he could make a statement relative to the character of the work they were carrying out. When, after the war, they could speak freely of those matters, he was sure the shareholders would be very well satisfied with what had been accomplished. Many organisations were now engaged in considering matters relating to reconstruction after the war. Many of those were of great value in fostering particular industries and thereby contributing in a marked degree to the welfare of the Empire as a whole, and already a great deal had been accomplished by the B.E.A.M.A., which

made a specific study of the problems relating to the electrical and associated industries. It was to be hoped that there would be greater concentration of effort among the many associations which appeared to be pursuing the same ends, so that there would be less overlapping and dissipation of valuable energy.

Callender's Cable and Construction Co., Ltd.

Presiding at the annual meeting on July 11th, Sir TOM CALLENDER (managing director), (who took the chair in the absence, through indisposition, of Sir Fortescue Flannery), said the report was a good one, especially having regard to the circumstances under which they had been working. Great difficulties had attended all engineering work which had been going on during 1917, and the results now shown had not been achieved easily, but were the outcome of much worry and anxiety and strenuous labour on the part of those in charge of the business. In order to arrive at this result close and cordial co-operation had been necessary throughout the whole business. There were few concerns where all pulled together better than they did in this Callender group. The delay which had taken place in presenting the balance-sheet had run all through the operations of the year. There had been many delays in getting goods turned out and in supplying their customers, but these were inevitable, and when they looked at the difficulties which had surrounded this country and the company itself, they could only express surprise that they had been able to do so much; for, in spite of all these difficulties they had done a record year's work. The amount of their output had been very great, and he did not think that the profits which they had made were really commensurate with the work which had been done; but they were all controlled by Government, and at times were subjected to a heavy hand on the part of those in authority. This was especially so in regard to labour, where the competent authority had on several occasions given awards which had been entirely unexpected, and which had applied to men and to industries to which they evidently were never originally intended to apply. In addition, they had had awards given in regard to wages which had been dated back by many months, and which had hit the company in some departments very heavily indeed, and had caused them great disappointment when they had come to look into certain of the accounts which ought to have come out better. These, however, were circumstances which were quite beyond their control. They were endeavouring to pass on these claims to the Ministry, as they held that the Government, having imposed upon the company certain additional expenses, should of necessity bear those expenses when it came to paying for the goods, and although they had said they would probably do so, up to the present they had been strangely diffident in regard to parting with that extra money. These, however, were little difficulties which they must expect to meet. All the factories in which the company was interested had been kept very busy during 1917, and all the work done had been of the greatest national importance. They were full of work at the present time, so that the outlook for the present year was a satisfactory one. With regard to the company's foreign work, they had, as was well known, very widespread connections in all kinds of electrical business in most parts of the world. Since the beginning of the war their operations under this head had been a good deal hampered, and this was particularly so during the year under review; but in spite of this fact they were managing to keep their connections going, and he was pleased to say matters were improving somewhat. There was now the possibility of sending materials to certain places abroad. He wanted to place on record the board's appreciation of the work done by those men abroad, especially in India, who represented this company, and who had had a very difficult time since the war broke out. He desired also to testify to the satisfaction which the board, and, he was sure, the shareholders, felt with the management and staff of the company and those in charge of the factories and contracts for the part which they had taken in producing the results now submitted. The directors recognised that, on the conclusion of the war, whenever that might be, the company would have to face conditions which would be entirely different from those now prevailing. They would have to start again the commercial business which, having been built up after many years of anxiety and trouble, had had to be set aside. They were making all their arrangements with a view to getting that new commercial work; but one point which struck the directors very forcibly was the difficulties under which they were going to labour by reason of the action of the Government in taking from them so much of the profit which had been made. They were reduced practically to their old standard, and they could get little more than they got in pre-war days, and out of that little surplus they had to spend large sums on new machinery, &c., which meant that, when peace came, they would not have sufficient funds in their coffers to be able to fight the enemy whom they would certainly have at their gate. They recognised the soundness of the financial policy of the Government, but regretted that the very sound policy which had been adopted would cause considerable inconvenience to this company and to other manufacturers in many lines of business when they resumed their commercial trade, because they would have no large reserve funds to meet the reconstruction of business which had been so much talked about, having had such a large share of their profits taken from them in the way of income-tax, excess profits duty, &c. Against that they had to bear in mind that Germany, who, in spite of all things, would be one of their chief competitors, had adopted a different method with her large manufacturers. Recent balance-sheets of important companies in the same line of business as that of this company showed immense reserves which appeared to be liquid and ready for immediate use, and it was openly stated that they would be entitled to use these in the rehabilitation of German trade in various parts of the world. He hoped it would be a long time before German trade with this country and with our Colonies and Dominions would be a serious menace, or a menace of any kind, to us; but there were wide stretches of country, especially in South America and in China, which were open to them and to us, and where we had before the war, and had maintained during the war, a certain footing at some expense. Great things had been hoped for in that direction, but that was where we should find the pinch, and our foreign competitors who had been lightly treated by their Government in regard to finance would be at a great advantage as compared with English firms, who had suffered under the heavy hand of the Government's exactions. Following upon this the directors could see it would be necessary that when the happy day of peace came, and perhaps sooner, they would have to ask the shareholders to approve the raising of further capital in this company, because, while they could carry on at present, and finance was easy when they were dealing with the Government and such authorities, it would be a very different case when they were once again in open competition for ordinary commercial business. It would be necessary then that the resources of the company should be increased, and probably considerably increased. When that day came he felt sure that the assistance which they would require from the shareholders would not be found wanting. In order to consolidate the business and to prepare for future work they were making some alterations in the management. He would continue to hold the position of managing director and to be active therein, and it was proposed that Mr. Petersen and Mr. James Callender, who had been assistant managers, should become managers of the company; Mr. Charles Pipkin, who had been with the company practically all his life, being brought in as assistant manager. The demands of the Ministry of War had necessarily made great inroads on their staff, and the men had been replaced to a large extent by women workers both in the factories and in the offices. Having referred to the casualties which had taken place among the members of the staff on active service and to the close touch which was maintained between the company and the men who were still at the front, the chairman proceeded to refer to the accounts. Dealing with the balance-sheet, he pointed out that in the year under review about £60,000 had been spent in additional buildings, machinery and plant, and he stated that the directors were in negotiation with the Government in regard to an allowance being made under this head in the assessment of excess profits duty. The gross profit for the year was £199,023, or an increase of about £9,000, which, as he had already pointed out, was by no means commensurate with the large amount of increased work done. The balance at credit of profit and loss account, £121,783, as compared with £117,590, so that in the net result they were about £4,000 better off than in the previous year. After payment of fixed charges £81,051 remained. The amount brought forward from 1916 was £249,207, and when it became desirable to make an alteration in the capital the directors, in accordance with powers vested in them, transferred from that amount to reserve the sum of £150,000, thus leaving £99,207 as the real carry forward, and giving them now an available balance of £180,258. It was proposed to raise the distribution on the ordinary shares for the year from 20 per cent. to 25 per cent. (5 per cent. of which had already been paid to the shareholders) this extra 5 per cent. being payable by way of bonus. They were carrying to reserve £25,000, bringing that account, after the completion of certain transactions, to the round sum of £100,000. This would leave £111,508 to be carried forward, subject to excess profits duty, if any.

Sir JOHN BORASTON congratulated the directors upon the results achieved, and the chairman and Mr. Tait upon the honours conferred upon them by His Majesty. He suggested that the remuneration of the directors should be increased from £2,500 to £3,000 per annum, but the SOLICITOR pointed out that effect could not be given to this suggestion at the present meeting. Mr. TODHUNTER having also offered his congratulations to the chairman on the distinction conferred upon him, The CHAIRMAN thanked the shareholders for their kind expressions. He mentioned that he had received from one of the leading trade unions in Lancashire a letter of cordial congratulation, expressing their hope that the happy relations existing between him and the company, on the one hand, and themselves on the other, might long continue. He treasured that letter even more than he treasured a great many others that he had received.

At an extraordinary general meeting which was afterwards held resolutions were unanimously passed altering the articles of association and approving the directors' recommendations with regard to the capital of the company with a view to the ordinary shareholders receiving as a bonus one fully-paid ordinary share of £5 for every ordinary £5 share now held by him.

United Electric Tramways of Montevideo, Ltd.

Mr. GEORGE BALFOUR, chairman, at the fourteenth ordinary general meeting, said that the accounts submitted were in accordance with the not very hopeful forecast foreshadowed last year. During the year the company's cars carried 44,883,520 passengers, an increase of 2,136,450 over last year. The gross receipts amounted to £359,833, being an increase of £12,060, which followed an increase of £17,172 last year. The operating expenses increased by £24,314, or 4.45 per cent. They absorbed 73.14 per cent. of the gross receipts, compared with an average of 57 per cent. under pre-war conditions. Net receipts showed a decrease of £12,254, following a decrease of £11,322 last year. The cost of fuel accounted for 83 per cent. of the total increase in expenses, and the increase due to wages represented slightly over 14 per cent., the balance being due to increased cost of materials for repairs and maintenance. The net profit for the year was £27,373, and it was proposed to carry forward a sum of £13,296. For the first time in the history of the company the payment of the preference dividend had to be postponed, but it was necessary to do so, the increased cost of coal alone, as compared with the previous year, being nearly equal to a year's dividend on those shares. The outlook for the current year indicated a repetition of last year's experience. For the first six months the gross receipts showed an increase of £19,438, but against that the operating expenses showed an increase of £25,202. The increased gross receipts, however, gave confidence in the stability of the undertaking.

Tata Hydro-Electrical Power Supply Co., Ltd.

At the eighth ordinary general meeting held in Bombay, Sir D. J. TATA, Kt., chairman, who presided, said the success so far as it had been achieved in spite of numerous and unexpected difficulties, should be a source of some satisfaction; while in July, 1915, they commenced with only seventeen consumers, these were increased to 31 in June, 1916, and the number of consumers taking power in June, 1917, had been further increased to 38, and the amount of energy supplied to many of them had steadily increased. The present war conditions had prevented a still further extension owing to the difficulty of getting machinery from England. All the transformers required for their second installation were ready for shipment, and some of the motors ordered were partially manufactured and would be completed after the grant of the priority certificates from the Munitions Department of Great Britain. Their arrival would mean that the mills of the second installation, which were now on the waiting list, would be put in commission electrically. Compared with the experience of electric power supplying companies in other countries, the waiting list of consumers for large amounts of energy with a well-regulated and steady load was no small advantage to them. The fifth generating set in the power house at Khopoli had been erected, and had been in operation for some time, so that, as soon as war conditions allowed of the equipment of the mills on the second installation, it would be possible to raise the present output of 30,000 H.P. to 40,000 H.P. at no distant date. This year they had strengthened the whole of their transmission line with the exception of a small section, the material for which was lost at sea. Two years ago he pointed to the extraordinary difficulties of carrying energy at a pressure of 100,000 volts along overhead transmission lines which crossed large creeks and salt pan areas. The moisture and the salt air made it unusually difficult to carry that voltage without mishaps. With increasing experience, their engineers had steadily overcome the difficulties, and they were now having fewer stoppages in a marked degree. The indemnities shown this year in the audited accounts covered stoppages from the commencement in 1915 up to the end of last year. The income had been steadily increasing; the highest point reached was in May, 1917, when they earned a gross income of about Rs. 2,60,000 for that month; as against that operation costs had remained about the same as in the preceding year. Dividends on preference shares at the rate of 7 per cent. per annum, and on ordinary shares, old and new, at the rate of 8 per cent. per annum, were declared.

Pernambuco Tramways and Power Co., Ltd.

At the sixth ordinary general meeting the chairman, Mr. WM. HIGGINS, said that the past year had been one of continued progress in every branch of business, and had it not been for the existing abnormal conditions they might have earned dividends on both classes of the share capital; nevertheless, they recommended a payment that would commence the dividend-earning period in the history of the company. The operating results showed a net increase over those of the previous year of £27,127. The tramway receipts had shown, and continued to show a progressive rate of increase. The whole of the systems of the old mule tramways and the Brazilian street railway had now been electrified, and there remained just over eight miles of steam lines, being part of what used to be the Olinda street railway. Notwithstanding the price of coal, the gas undertaking had shown a profit for the year. Improved plant enabled a saving of 50 per cent. to be made in the amount of coal carbonised. A remunerative future was anticipated for this branch of the business when circumstances and prices again became normal. With regard to the supply of electricity for lighting and power, great difficulties had been met with in obtaining the necessary materials and shipping permits. They still hoped for good results from this branch of the business. The Telephone Co. continued to show satisfactory progress; the number of subscribers and receipts had increased. During the year they had also enjoyed a better rate of exchange, averaging 12.81d., as against 12.06d. in 1916. With regard to the future, the prospects were satisfactory; the total increase in traffic receipts this year to date were £22,000, and the net working results also showed an improvement compared with 1917. A dividend of 3½ per cent., less income-tax, was declared on the 7 per cent. non-cumulative participating preference shares.

Crompton and Co., Ltd.

Mr. C. F. TUFNELL, presiding at the annual meeting on Tuesday, said that they regretted having again to disappoint the shareholders in the matter of accounts. They were not yet able to issue the accounts for the year ending March, 1917, which were postponed from last year. The question of war taxation and other matters in respect of that year had still to be settled. They were, therefore, in practically the same position as they were at the annual meeting last August. The business continued to make progress in a satisfactory manner. Compared with the year ended March, 1916, which was the last year for which they had had the accounts, the output from the works for the year ended March, 1918, showed an increase of 98 per cent., or very nearly double, whilst the work in hand at the present moment was more than double the figure at which it stood in March, 1916. They would never have been able to handle the volume of work which they had turned out this year but for the foresight of the management in providing additions to the company's premises and plant during the early days of the war. Further expenditure under those heads had been incurred during the year under review, including extension and improvement of the accommodation for women, of whom an increasing number was being employed. Since the close of the year they had given notice to the debenture holders of their intention to repay the £100,000 5½ per cent. mortgage debentures in September next. Those debentures in any case were repayable in December of next year, but after careful consideration the directors came to the conclusion that it would be better for two reasons to anticipate that date. In the first place, they had ascertained on what terms new debentures could be issued now, whereas no one could tell with certainty what the conditions of the money market might be in December of next year. Then, in the second place, it gave them an opportunity of increasing the issue from £100,000 to £150,000, a useful addition to their working capital. The new debentures bore interest at the rate of 6 per cent. per annum, and the whole issue, except a reserve of £20,000 had been placed. Their relations with their employés had been entirely satisfactory throughout the [illegible] they were turning out was excellent. He would like again to take the opportunity of thanking Mr. Reeves, the managing director and secretary, and Mr. Britten, the manager at Chelmsford, and their loyal staff for their successful work. The prospects for the current year were good, and so far as regarded trading when the war was over, all he need tell them was that if trade was good they would be in a position to profit by it, and if trade was bad—an unlikely contingency in the opinion of many—he could, at any rate, assure them that their organisation and the arrangements they had made during the last few years would stand them in very good stead.

Following the declaration of the dividends a resolution was passed adjourning the meeting to a subsequent date, of which due notice will be given the shareholders, for the purpose of the presentation of the past year's accounts.

Edmundson's Electricity Corporation, Ltd.

In the annual report to which we referred briefly last week the usual schedule is given of the capital expenditure and gross profits of subsidiary and other companies. We reproduce the figures for the year ended December, 1917:—

Name.	Capital expended Dec. 31st, 1917.	Gross profit (before providing for capital charges and depreciation), 1917.	Load connected in KW. 1917.
Alderley	£54,691	£2,662	1,196 KW.
Bromley	165,312	9,828	4,771
Folkestone	298,943	15,719	5,455
Guernsey	100,454	3,842	5,027
Isle of Wight	272,026	6,471	5,883
Ilfracombe	35,591	596	861
Lancashire Co. ..	684,352	42,031	25,311
Lymington	36,951	1,419	760
Melton Mowbray ..	40,276	1,956	929
Newmarket	44,647	2,020	1,086
North of Scotland ..	116,184	6,643	3,793
Ramsgate	51,686	2,578	1,452
Scarboro' Trams ..	99,480	82	—
Salisbury	74,079	5,713	1,729
Urban Co.	1,449,070	81,550	26,902
Wycombe	113,397	5,944	2,729
Cromer	34,376	813	616
Dorking	46,195	2,261	1,095
Frome	62,186	2,758	2,077
Hamilton	85,809	4,405	3,015
Surbiton	60,009	4,300	1,970
Total	£3,995,146	£203,609	106,654 KW.
1916	£3,854,981	£187,441	99,095 KW.

The annual meeting was held yesterday.

Marconi's Wireless Telegraph Co., Ltd.

The net profit for the year ended December, 1917, was £383,835, and adding the amount brought forward there stands to the credit of profit and loss account £763,942. In addition to the dividends paid in February there is now recommended a dividend on the ordinary shares of 15 per cent. for the year ended December 31st, 1917 (making 20 per cent. for the year), and one on preference shares of 10 per cent. for the year (making 17 per cent.). There is to be put to general reserve £100,000, and £376,904 is to be carried forward. The general reserve will now stand at £1,100,000. The shares in associated companies and patents are taken into account in the balance sheet at their cost price, namely, £1,498,083, an increase during the year of £94,159. The par value of the shares now stands at £2,697,286, exclusive of shares which have no capital denomination, which shows an increase over last year of £209,835.

Owing to unfavourable rates of exchange large sums of money received in foreign countries continue to be invested temporarily or placed on deposit abroad. The loss represented by the rates of exchange has been written off against profit and loss account. If upon realisation the rates of exchange will have improved, the differences will appear as profit in another year.

The company is still without any remuneration or compensation from the Government for the use since the beginning of the war of the company's high-power stations, and for the considerable services which have been rendered. For the fourth year in succession, therefore, it has been impossible to include in the accounts any sum in respect of these matters.

The negotiations with the Post Office for compensation in respect of their repudiation of the contract for the Imperial chain of stations, to which reference was made in the report of last year, proved abortive, and the company, having exhausted every effort for a friendly settlement, found itself compelled to proceed with its petition of right. After counsel had opened the case on behalf of the company, the Attorney-General, on behalf of the Crown, consented to judgment being entered for the company with costs. The amount of damages to be paid to the company will be decided in due course by the Referee appointed by the Court.

The Marconi International Marine Communication Co., Ltd., has continued to show very substantial development, and dividends for the past year amounting to 15 per cent. have been declared and paid, and a sum of £105,418 has been carried forward, subject to excess profits duty for 1916 and 1917. The rapid increase in the company's business called for further additional capital, and an issue of 250,000 shares at 15s. premium was offered to the shareholders, and substantially over-subscribed.

The French company, La Compagnie Francaise Maritime et Coloniale de Télégraphie sans Fil, has declared a dividend for 1917 at the rate of 20 per cent. on the ordinary shares, and 281.25 francs per share on the founders' shares.

The Amalgamated Wireless (Australasia), Ltd., has declared a dividend of 5 per cent. for the year ending June 30th, 1917.

The Marconi Wireless Telegraph Co. of America has declared a dividend for the year 1917 at the rate of 5 per cent.

The Russian company, the Societe Russe Telegraphes et Telephones sans Fil, declared no dividend for the past year. There is, however, reason to believe that the position of the company, considering the circumstances, is not unsatisfactory.

Arbroath Electric Light & Power Co., Ltd.—The profit for 1917 amounted to £2,830, plus £373 brought forward. There is to be put to reserve and renewals fund £1,000; dividend 5 per cent., less income-tax, on ordinary shares, £860; carried forward £417. The quantity of current generated and sold was very satisfactory, but the cost of production was much higher than formerly, and this has prevented the company obtaining the full benefit of the additional load. There have been a good many applications for current during the year, but the Government restrictions precluded their acceptance, except in special circumstances.

Stock Exchange Notices.—The following securities are to be quoted officially:—

British Electric Transformer Co., Ltd.—38,012 additional 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 161,989 to 200,000).

Llanelly and District Electric Lighting & Traction Co., Ltd.—100,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 60,001 to 135,000 and 150,001 to 175,000).

City & South London Railway Co.—Interim dividends on the 5 per cent. preference stocks 1891, 1896, 1901, and 1903 of 2½ per cent., and on the consolidated ordinary stocks of ¾ per cent.

Application has been made to the Board of Trade for power to extend the time for the payment of interest out of capital provided for under the Act of 1913.

Greenwood & Batley, Ltd.—After placing to depreciation £5,000 and to reserve £50,000, the directors recommend a final dividend on the ordinary shares of 10 per cent., tax free, leaving to be carried forward £13,962.

Edison Swan Electric Co., Ltd.—A petition for confirming a resolution reducing the capital from £888,071 to £698,307 is to be heard on July 30th.

Madras Electric Supply Corporation, Ltd.—Dividend 4 per cent. on ordinary shares for the year; £7,000 is put to depreciation and renewals, and £5,727 is carried forward.

Central London Railway Co.—Interim dividend of 1¾ per cent. on the undivided ordinary shares and 2 per cent. on the preferred ordinary for six months.

London Electric Railway Co.—Dividends, 2 per cent. on the 4 per cent. preference stock and ¾ per cent. on the ordinary for the half-year.

Hadfields, Ltd.—Interim dividend 1s. per share, free of tax, on the ordinary shares.

Cape Asbestos Co., Ltd.—Dividend on the ordinary shares 5 per cent., less tax; £5,908 carried forward.

Singapore Electric Tramways, Ltd.—The report for 1917 states that after charging debenture interest, depreciation, and royalty to the municipality on tramway profits for 1916, the profit was £4,274, plus £7,946 brought forward. After allowing £5,000 for dividend paid in July, 1917, transferring £3,000 to depreciation, £4,221 is to be carried forward. Car mileage decreased 108,292 miles. Passengers per car mile were 6.53, against 6.19. Power expenses were £21,803, against £17,005, due to cost of coal. Sales of energy for lighting and power increased £1,289 to £14,611. Abnormally high price of coal greatly increased cost of energy, and at close of year current was being supplied under contract to Singapore Municipality at a loss. Position was put before Commissioners, who declined to agree to any increase in the rate at which electricity is supplied to them, although the net profits to the municipality for 1917 in their electrical department were £10,614. In December last crank shaft of one Diesel engine broke, causing considerable damage. Engine still out of commission. For the present the bulk of the energy required is being produced by the steam sets.—*Financial Times.*

Metropolitan District Railway Co.—Interim dividends of 2 per cent. on the guaranteed stock, 2¼ per cent. on the first preference, and 1¼ per cent. on the 5 per cent. second preference.

Calcutta Electric Supply Corporation, Ltd.—Units sold to consumers during the four weeks ended April 26th, 2,509,519, compared with 2,174,348 units last year.

St. James's & Pall Mall Electric Light Co., Ltd.—Interim dividend at the rate of 7 per cent. per annum on the ordinary shares for the June half-year.

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE markets were not much affected by the commencement of the German offensive on Monday, and the first news of the results achieved by the enemy was regarded as distinctly encouraging from our point of view. Except in a few cases where there had been a little too much buying in advance, prices held their ground with noticeable strength. It is surprising how well the Home Railway market is maintained considering how small is the amount of business. The first dividends to be announced were those of the Tube railways. The City & South London pay ¾ per cent., Central London 1¼ per cent., London Electric ¾ per cent., and the District announces 1½ per cent. on the Second Preference stock. At the same time, the Underground Electric Railways of London have declared a dividend of 4 per cent. on the Income Bonds. These rates are all the same as those of a year ago, and are much in accordance with the market anticipations, except that of the Underground Co. Some optimists had been looking for an advance upon the 4 per cent. declared last year upon the Income Bonds, although it was tolerably obvious that the fare-raising had been in force far too short a time to cause it to have any material effect upon the takings for the last half-year. The price of the bonds has weakened to 82½, and the £10 shares fell to 2½. Metropolitans are also lower at 23¼.

Attention is being directed to several of the Tramway issues in the Metropolitan list. London and Suburban Traction 5 per cent. Preference have risen to 7s. 3d., with a fair amount of business doing in the shares. The First Mortgage Debenture stock stands at 60, and the 5 per cent. "A" Debenture stock at 80, while the Ordinary are in the neighbourhood of 2s. London United Debenture keep steady at 41—Metropolitan Electric 4¼ per cent. Debenture stock changed hands the other day at 70½. Low-priced Tramway shares are fairly popular amongst a certain class of speculative buyers. Pernambuco Ordinary were run up to 8s. 3d., and the 7 per cent. Preference to 15s.

There is a better tone in the market for Anglo-Argentine Trams, buyers having come along for the First and Second Preferences on the basis of 3¼ and 2 9/16 respectively, while there is a harder tendency about the debenture stocks. British Columbia descriptions keep firm, and in a private letter just received from Vancouver, the writer refers to the more promising conditions which now prevail in that city, and in the province as a whole. Mexicans continue firm as a whole, but definite news is awaited with an eagerness just tinged with anxiety. Mexican Light & Power preferred are 3 points better on the week.

The course of prices in the Telegraph market continues upwards. Eastern Ordinary, Eastern Extensions, and Direct United States shares are ex dividend. Allowing for the deductions, there is no particular change in prices. Oriental Telephone Ordinary at 4¾ are ex the dividend and bonus, and the 6 per cent. Preference at 20s. are xd. Indo-Europeans have had a big rise of £9 a share to 58½, which brings them within 10s. of the pre-war making up price of July, 1914.

The Marconi report is very satisfactory, and the dividend is raised to 20 per cent. for the year. The profits have risen from £318,400 to £383,800, and allowing for the carry-forward there is a disposable amount of £137,000 more than there was in 1916. The Preference shares get 17 per cent. instead of 12 per cent., and the Ordinary dividend of 20 per cent. is

5 per cent. more than that for 1916. The reserve is raised to £1,100,000, and £377,000 goes forward. It is stated in the report that no settlement has yet been arrived at with the Government for the use of the Marconi high-power stations and other services, but the claim for compensation will be settled in due course by the referee appointed by the Court of Appeal. The price of the shares is firm at 3⅛, and a good deal of business is doing in the subsidiaries. Canadians are good at 12s., and there has been a rise in Spanish and General to about the same figure, while Americans keep firm at 25s. 3d. xd.

Babcock & Wilcox are a strong market, and have added another 2s. 6d. to their last week's rise of 3s. 9d. British Aluminium have also improved. Callender's recovered their dividend straight away; Henley's are 5s. up at 21½. Telegraph Constructions are also the same price xd., as last week they were cum dividend. General Electric have risen £1 to 27½. The preference at 10⅜ are 5s. easier. Edison Swans are a little lower at 3 5/16 for the fully-paid, and 40s. 6d. for the £3 paid, though the Preference are in eager demand at 43s. and upwards. Cromptons are firm at 15s. on the declaration of a 7 per cent. dividend on the Ordinary.

The Electric Lighting list is as quiet as ever, and no changes have occurred except ¼ rise in Chelseas, and a similar fall in St. James's. The tendency, however, continues to be rather dull owing to the apprehension already noticed that there may be some slight reduction in the dividends in respect of the current year. Other Industrials are mostly on the up-grade. Rubber shares are a trifle harder, attracting very little notice for the time being. In the base-metal markets, nothing of importance has occurred.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price July 16, 1918.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	9	10	6⅛	—	£7 13 10
Charing Cross Ordinary	5	4	3½	—	6 3 1
do. do. do. 4½ Pref.	4½	4½	3⅝	—	6 18 6
Chelsea	3	5	3½	+ ¼	7 13 10
City of London	8	8	11	—	7 5 6
do. do. 6 per cent. Pref.	6	6	9⅝	—	6 0 4
County of London	7	7	10½	—	6 16 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	5½	—	6 18 4
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 13 10
Metropolitan	3	4	3⅝	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3⅜	—	7 4 0
St. James' and Pall Mall	8	9	6½	— ¼	6 13 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6⅛	—	7 7 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	95xd	—	6 6 4
do. Def.	1½	1½	22	—	6 14 10
Chile Telephone	8	8	9½	—	4 6 6
Cuba Sub. Ord.	7	7	9⅜	—	*7 3 7
Eastern Extension	8	8	154xd	—	*5 3 8
Eastern Tel. Ord.	8	8	157xd	—	*5 1 7
Globe Tel. and T. Ord.	7	7	144xd	—	*4 17 5
do. do. Pref.	6	6	94xd	—	6 0 0
Great Northern Tel.	24	22	88	—	5 15 9
Indo-European	13	—	48½	+ 9	5 11 1
Marconi	15	20	96	+ ¼	5 10 4
Oriental Telephone Ord.	10	10	4½xd	—	2 2 2
United R. Plate Tel.	8	8	7½	—	*5 10 5
West India and Panama	6d.	9d.	1	—	*3 6 8
Western Telegraph	8	8	15⅛	—	*5 0 10
HOME RAILS.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	23½	—1	4 6 0
do. District	Nil	Nil	19	—	Nil
Underground Electric Ordinary	Nil	Nil	2½	+ ¼	Nil
do. do. "A"	Nil	Nil	6/3	—	Nil
do. do. Income	6	4	82½	— ½	*4 17 0
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	8	+ ⅛	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	65	+1	7 13 10
Brazil Tractions	—	—	42	—	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Ry. Pfce.	5	5	61½	—	8 2 8
do. do. Preferred	Nil	Nil	46½	—	Nil
do. do. Deferred	Nil	Nil	41½	+1½	Nil
do. do. Deb.	4½	4½	62	+ ½	6 17 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	44½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	36½	—	Nil
Mexican Light Common	Nil	Nil	21	—	Nil
do. Pref.	Nil	Nil	35½	+ 3	Nil
do. 1st Bonds	Nil	Nil	49	+1	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	8½	+ ½	4 1 6
British Aluminium Ord.	10	10	1⅝	+ ⅛	5 6 8
British Insulated Ord.	20	20	1⅜	—	5 6 8
British Westinghouse Pref.	7½	7½	2⅛	—	5 14 3
Callenders	20	25	19½xd	+ ½	6 11 7
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3⅞	—	5 16 0
Edison-Swan, fully paid	—	—	3⅛	—	Nil
do. do. 4 per cent. Deb.	4	4	74½	—	5 7 5
Electric Construction	7½	10	1⅛	—	7 12 4
Gen. Elec. Pref.	6	6	10½	— ½	6 1 0
do. Ord.	10	10	27	+1	*3 12 9
Henley	25	25	21½	+ ½	5 16 3
do. 4½ Pref.	4½	4½	8⅞	—	5 12 2
India-Rubber	10	10	10½	—	*6 4 6
Telegraph Con.	20	20	44xd	+ ½	*5 8 8

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 17th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	"	£75	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£42	..
a Copper Sulphate	"	£35	..
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£17 5/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£36	..
a " Lump	"	£25	..
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 3" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/8½ to 1/2	1½d. inc.
g " Bars (best selected)	per ton	£149	£3 inc.
g " Sheet	"	£149	£3 inc.
g " Rod	"	£149	£3 inc.
d " (Electrolytic) Bars	"	£137	£12 inc.
d " Sheets	"	£152	..
d " Wire Rods	"	£145	£12 inc.
d " H.C. Wire	per lb.	1/5½	1½d. inc.
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
a German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/1	½d. inc.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£37	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 3/-	..
e " " " medium	"	3/6 to 6/-	..
e " " " large	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/5½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	4/6	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

London Engineers Oppose the Whitley Report.—The *Daily Telegraph* states that the London District Committee of the Amalgamated Society of Engineers has issued an instruction to all shop stewards and branches in the London district not to take part in the formation or working of any committee constituted on the basis of the Whitley Report, on the ground that "the fundamental antagonism of the interest between employer and employed offers an insuperable barrier to any joint control of industry, and that the next step on the road to control by the workers is the creation of a strong, co-ordinated, class-conscious movement in the workshops." The Committee, in a statement issued, says that workers have nothing in common with the sentiments expressed in the Report, and, if its recommendations are carried out in the spirit in which they appear to be made, the consequences to the Trade Union movement cannot be other than disastrous. Mr. Sam Bradley, the secretary of the London District Committee, said it was feared that in practically every district the Whitley Committees would be dominated by the employers, and in ninety-nine cases out of a hundred it would be impossible to reach agreements.

A Solderless Cable Joint.—The Siemens-Schuckert Werke advertises a new method of making joints in electric cables. The bare cables are pushed from either end into an oval sleeve of metal; the sleeve is indented at a number of places along its length by means of a special screw-operated hand-vice. The advantage of this method of making joints consists in the avoidance of damage to the strands of the cable and the efficient protection to the zinc surface on the wires. The joints have the same tensile strength as the cable itself. The process is cheap, and can be carried out by unskilled labour. This method of jointing is described more fully in an article by A. Vilanova, in which photographs are included of joints with the sleeve partly removed. The new joint is compared with riveted and screw joints, and it is claimed as a special advantage that its use will save very great quantities of screws and rivets.—*E.T.Z.*, May 9th.

Gibraltar Straits Tunnel Scheme.—The Paris *Excelsior* published, on July 11th, an article dealing with the advantages of a tunnel under the Straits of Gibraltar. The General Congress of Civil Engineers has drafted a scheme for the construction of such a tunnel, and the Orleans Railway Co. has submitted the draft to the Government, asking for a concession. The Spanish Government has instructed a colonel of Engineers to make an inquiry into the subject.

THE USE OF HIGH-PRESSURE AND HIGH-TEMPERATURE STEAM IN LARGE POWER STATIONS.

By J. H. SHAW, A.M.I.E.E.

(*Abstract of paper read before the* Yorkshire Local Section *of the* Institution of Electrical Engineers, *at Leeds.*)

It is apparent that in order to increase the heat efficiency of a steam plant, whose characteristics are that a constant loss is inevitable whatever the temperature and pressure, it is necessary to increase the working range of temperature and pressure.

The lower limit is generally decided by the locality of the power station. A works equipped with cooling towers cannot expect to obtain a lower bottom temperature than 75 deg. F.; a bottom temperature of 80 deg. F. is more to be expected, which will give 28 in. vacuum or 2 in. absolute pressure. With cooling water at a temperature of 60 deg. F. condensing plant for vacua between 28.5 and 28.8 in. can be installed.

As regards the upper range, doubt exists as to whether it is the more economical to increase the temperature of the steam by superheating or to increase the range by the use of higher pressures and a moderate amount of superheat.

Plant has been installed by the British Thomson-Houston Co. at their Rugby power house, consisting of a B.T.H. turbine and a Babcock & Wilcox marine-type boiler, capable of a normal evaporation of 18,000 lb. per hour with feed water at 80 deg. F. (the working pressure being 350 lb. per sq. in., the final temperature of the steam after passing the superheater 700 deg. F., and the test pressure of the boiler 525 lb. per sq. in.). Good results have been obtained from the combination, and an inspection of the machine after about a year's operation showed no undue signs of wear.

At the Carville power station, Newcastle-on-Tyne, the latest section of the boiler house is designed for 275 lb. pressure, and at Glasgow the boiler pressure at the new works is to be 250 lb. per sq. in.

SCHEDULE I.—Absolute Pressure at Turbine Exhaust, 1·5 in. (Hg.) (91·7° F.). Condensate Temperature. 85° F.

Steam pressure at turbine.	215 lb. per sq. in. (abs.)		365 lb. per sq. in. (abs.)		500 lb. per sq. in.
Superheat of steam at turbine, °F.	150°	300°	150°	300°	208°
Total temperature of steam, °F.	537·9	687·9	586·4	736·4	736·4
Total heat in steam from 32° F., therms per lb.	1,293	1,371	1,307	1,389	1,382·7
Heat drop per lb. of steam, therms.	391	429·2	428·7	470·2	485
Ratio efficiency of turbo-alternator, %.	77·6	79·5	77·6	80	80·2
Internal efficiency of turbine, %.	82	84·0	82·0	84·5	84·6
Steam consumption of turbine, lb. per kw.-hour.	11·25	10·0	10·28	9·15	8·89
Total steam consumption of turbine, lb. per hour.	225,000	200,000	205,600	183,000	177,800
Heat rejected to condenser from 32° F., therms per lb.	973	1,010	955	991	972·7
Circulating water, galls. per hour.	1,012,500	940,000	925,200	840,000	785,000
Total power for auxiliaries, kw.	515	485	530	485	510
Net output to bus-bars, kw.	19,485	19,515	19,470	19,515	19,490
Heat in steam from temperature of hot-well, therms per lb.	1,240	1,318	1,254	1,336	1,329·7
Steam consumption per effective kw.-hour, lb.	11·55	10·25	10·55	9·39	9·124
Pounds of steam evaporated and superheated per lb. of coal, lb.	6·25	5·9	6·2	5·8	5·83
Coal consumption per effective kw.-hour, lb.	1·85	1·74	1·70	1·62	1·565
£ Cost of coal at 10s. per ton, generating 175·2 × 10^6 kw.-hour.	72,000	67,600	66,400	63,750	61,250

A good case can be made out for a jump to 600 lb. pressure with a total temperature of 700 deg. to 800 deg. F., but this will involve a considerable amount of development charges being borne by the first undertakings to adopt such a pressure. On the other hand, it appears that practically all designs of existing apparatus can be so modified as to admit of pressures of 350 to 400 lb. per sq. in.

When considering any results of tests on high-pressure or high-temperature steam generating plant, it is essential that the tests on the boiler side and the tests on the turbine side be studied separately; further, it must be remembered that any results obtained on an extra-high-pressure boiler can be obtained and, considering the boiler apart from the economiser, surpassed on a similar and similarly equipped low-pressure boiler.

For a comparison between the cost of running a power station at 200 lb. pressure (gauge) and at 350 lb. pressure, Schedule 1 has been prepared. It is proposed to consider a riverside station, where the water is suitable for surface condensing. It is proposed to install 20,000-kw. sets, and coal is assumed to be within a reasonable distance; the cost of coal, with a net calorific value of 10,000 therms per lb., is for the purpose of the schedule assumed to be 10s. per ton at the works. The incombustible contents of the coal would amount to 20 per cent. The average water temperature is taken to be 60 deg. F., and the vacuum 28.5 in., with the barometer at 30 in. The overall efficiency of the boiler-house plant is assumed to be 77.5 per cent., which should be obtained with modern boiler control.

A turbine ratio efficiency of 80 per cent. is assumed, at both 200 lb. pressure and 350 lb. pressure with the steam superheated 150 deg. F., and a constant vacuum of 28.5 in. The corrections used for obtaining the consumptions at different steam temperatures are taken from Mr. Baumann's paper.* An alternator of 20,000-kw. capacity can no doubt be built to give an efficiency of 97 per cent. at unity power factor, thus making the turbo-generator ratio efficiency $0.80 \times 0.97 = 77.6$ per cent. Assuming bearing and other friction losses to absorb 2 per cent., the internal efficiency of the turbine will amount to 82 per cent.

Schedule 1 shows the comparisons of coal, steam, and heat consumptions for a 20,000-kw. machine running under the conditions mentioned, at 200 lb. and 350 lb. pressure by gauge at varying superheats; also at 500 lb. pressure absolute and 208 deg. F. superheat, at which pressure and superheat the total temperature will be 736.5 deg. F., which is about the maximum temperature at present recommended for the materials now being used in turbine construction.

The cost for coal when generating 175.2 million kw.-hours with a load factor of 100 per cent. will be £64,400 at the higher pressure (superheat 250 deg. F.), and £69,200 at the lower pressure with corresponding superheat. This is a saving of £4,800 per 175.2 million kw.-hours, or 0.007d. per kw.-hour. Unfortunately, a load factor of 100 per cent. is impossible, and the conditions under which power stations are operated must be considered before even an approximate estimate of working costs can be arrived at.

A method of computation which is sufficiently accurate for this purpose is to assume that the ratio of the station output to the total coal consumed is in accordance with Willans's law, *i.e.*, a straight line.

Fig. 1 is plotted from results obtained at the Bradford Corporation's Valley Road power station for a number of days during the year 1917. On this curve the weight of coal used

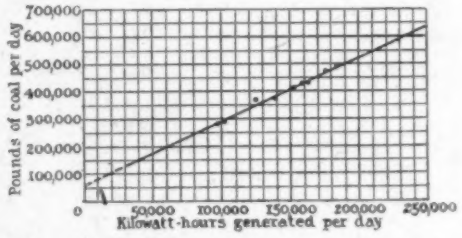

Fig. 1.—Station Conditions:—180 lb. per sq. in. (gauge); 100 deg. F. superheat; 28 in. vacuum; 30 in. barometer.

is shown to be 60,000 lb. per day, plus 2.32 lb. per unit generated. The quantity of coal per day, *i.e.*, 60,000 lb., is the no-load consumption of the works, and will include the no-load consumption of one turbo-generator. In order to make the calculations as simple as possible, it is proposed to deduct the no-load consumption of one machine (5,500 lb. of steam per hour) from the works' no-load consumption, to assume an evaporation of 6 lb. of water per lb. of coal, and to call the figure so obtained the works' standing loss. This = 1,583 lb. of coal per hour.

It is proposed to assume that the standing loss of the station designed for 200 lb. will be the same as for the Valley Road power station, *i.e.*, 1,583 lb. of coal per hour. The same basis is taken for the plant at 350 lb. pressure, with 8 per cent. added to the works' standing loss, representing roughly the higher temperature of the steam at the higher pressure. Standing losses must be approximately proportional to the top temperature, as this affects radiation, boiler exit losses, &c.

For a 20,000-kw. set the no-load consumption will be approximately 22,000 lb. of steam, or 3,666 lb. of coal per hour. These figures plotted in conjunction with the steam consumptions shown in Schedule 1 give the total steam consumption at any load as 22,000 lb. + 9.54 lb. of steam per kw.-hour for the plant operating at 200 lb. pressure, and 22,000 lb. + 8.6 lb. of steam per kw.-hour, and 3,729 lb. + 1.45 lb. of coal per kw.-hour for the plant operating at 350 lb. pressure and 250 deg. superheat.

In order to allow for reduced efficiency due to adverse cir-

* *Journal*, I.E.E., 1912, Vol. 48, p. 768.

cumstances, it will be advisable to add 5 per cent. to the figures obtained for the load consumption, and 5 per cent. to the no-load loss of the turbine, thus making the consumptions and costs as below. (Maximum load of 20,000 KW. and 50 per cent. load factor, 87.6×10^6 units per annum, 250 deg. superheat, 28.5 in. vacuum.)

	200 lb. pressure.	350 lb. pressure.
Works standing loss in tons of coal ...	6,200	6,700
No-load consumption of turbo-generators in tons of coal	15,100	15,314
Load consumption of turbo-generators in tons of coal	65,300	59,867
Total	86,600	81,881
Lb. of coal per unit on station bus-bars ...	2·211	2·094
Total cost at 10s. per ton	£43,300	£40,940
Cost of coal per unit	0·119d.	0·1122d.

SCHEDULE II.

	215 lb. per sq. in. abs.	365 lbs. per sq. in. abs.
Total heat of steam (from 32° F.) therms per lb.	1,345·5	1,363
Heat drop per lb. of steam, therms ...	401·3	441·6
Ratio efficiency of turbo-alternator ...	79 %	78·9 %
Steam consumption per KW.-hour, lb. ...	10·75	9·85
Heat rejected to condenser, therms per lb.	1,011·5	996
Ratio of circulating water to steam ...	63·5	62
Total power required for auxiliaries, KW.	730	700
Lb. of steam per KW.-hour on bus-bars...	11·1	10·2
Lb. of coal per KW.-hour on bus-bars ...	1·79	1·675
Cost of coal at 10s. per ton per $175·2 \times 10^6$ KW.-hours	£70,000	£65,200

Circulating water at 80 deg. F. discharged from condenser at 96 deg. F. Efficiency of boiler house, 77.5 per cent. Coal with a net calorific value of 10,000 therms per lb. The head against which the circulating pumps have to work is taken to be 50 ft.

Schedule 2 shows the coal required, and power for auxiliaries, for a cooling-tower station working at 200 lb. per sq. in. (gauge), 250 deg. F. superheat, and 350 lb. per sq. in. (gauge), 250 deg. F. superheat, exhausting against a back pressure of 1 lb. absolute pressure.

The foregoing relates only to the cost of coal; the remaining items which make up the total works' costs are not likely to be affected by the use of higher pressures and temperatures. The capital cost of the plant may be affected to a considerable extent, but unfortunately the increased cost cannot be given at a time like the present. Whereas before the commencement of the war a 5,000-KW. turbine, alternator, and condenser could be purchased for £2.9 per KW., a machine of 20,000 KW. capacity now costs £4.1 per KW.

With regard to the practical difficulties, before pressures of 500 lb. or 600 lb. per sq. in. are adopted, a radical departure will have to be made from present boiler construction. All square boxes and headers will be eliminated, the drums and tubes will be smaller in diameter, and the design of the boiler will be more elastic. The boiler will no doubt assume the the appearance of a flash boiler, with practically no steam or water reserves, and fired by gas on the surface-combustion principle.

For more moderate pressures, up to 350 lb. per sq. in., the existing type of boiler can be modified and successfully used. At Carville power station Babcock & Wilcox marine-type boilers are being used, at 275 lb. per sq. in. gauge pressure, and at the British Thomson-Houston Co.'s works at Rugby a Babcock & Wilcox boiler is installed and successfully working at 350 lb. per sq. in. Further, Messrs. Babcock & Wilcox have two boilers on order for a working pressure of 475 lb. per sq. in. with steam superheated to a final temperature of 700 deg. F., and are quite prepared to supply boilers in their ordinary business for such pressure and superheat.

With higher steam pressures the temperature of saturation is raised, and greater care must be exercised in the quality of the water used for the boiler feed. A feed water that is perfectly satisfactory at 380 deg. F. in a modern tubular boiler might be quite unsuitable for use in a flash boiler. The quantity of air, CO_2, and oxygen will have to be kept down to a minimum, and also the insoluble salts in the water discharged from an ordinary lime-soda water softener. A natural development, and one which is already taking place, is to heat the feed water under atmospheric pressure by means of live or exhaust steam in order to drive off the entrapped and dissolved gases as much as possible. It is necessary to raise the temperature of the water to 100 deg. C. before the quantity of air in the water is appreciably reduced.

The source of water for use in high-pressure plants will have to be carefully traced, and the treatment of the water should be such that a minimum of insoluble salts remains in it after treatment. The purer the water the greater affinity it has for air, CO_2, and oxygen, and every care should be taken that it is not exposed to the air between the condenser and the boiler. In order to avoid such exposure to the air, the feed pump should be an extension of the condensate pump, and the condensed water pumped direct into the feed line.

The natural development of the turbine for higher pressures appears to be in line with the Parsons two-cylinder machine, with a flexible claw-type coupling between the cylinders and a thrust bearing for each cylinder. For very large sets, above 50,000 KW., the cross-compound turbo-generator will no doubt be used, the high-pressure turbine being attached to one generator, and the low-pressure turbine to another. Each set can then be run at its most suitable speed, with resulting high efficiency. This arrangement will no doubt lead to reheating the steam after it leaves the high-pressure turbine and before it enters the low-pressure machine.

With steam initially at the same temperature, but at different pressures, the plant using the high-pressure steam will reject less heat units to the condenser per lb. of steam used in the turbine.

The steam pipes to be used in a station where both high pressures and high temperatures are employed will have to be very carefully designed. The question of expansion at higher temperatures will be of the utmost importance. For example, take the case of a steam pipe 100 ft. in length, and assume that the pipe had been erected at 60 deg. F. It will be found that at a temperature of 388 deg. F., equal to steam at 200 lb. gauge saturated, the expansion is 2.59 in., while at 786.6 deg. F., equal to steam at 600 lb. pressure and 300 deg. F. superheat, the expansion is 5.75 in.

The expansion given can be readily taken care of if the designer can ensure that the expansion will always take place lengthwise in the pipe range. Unfortunately, taking a boiler off a range will cause a considerable cross-strain to the main header, due to the connecting pipes cooling down and contracting.

It appears that the main steam connections of the boiler will have to be designed in a flexible manner, in order to relieve the main range of stress. Further, these connections should be of the manifold or header type, *i.e.*, made up of many small pipe connections.

The specific volumes in cubic feet per lb. of steam at approximately 800 deg. F. and at pressures of 200 lb., 350 lb., and 600 lb. by gauge, are 3.47, 2.10, and 1.25 cu. ft. per lb. Unfortunately the relative areas of steam pipes cannot be reduced proportionately to the specific volumes, as the friction of the denser steam would cause undue pressure drop. Proportioned according to the density of the steam, a pipe to supply a 20,000-KW. set could have a diameter of 12 in. at 200 lb. gauge and 800 deg. F. total temperature, and a diameter of 7.25 in. at 350 lb. pressure and 800 deg. F. superheat, with a velocity of approximately 150 ft. per second. In actual practice the diameters would approximate to 14 in. and 10 in. for 200 lb. and 350 lb. respectively.

There is no doubt that a large portion, in fact the major part, of the pressure drop in steam pipes as at present erected is due to the method of arranging ring mains and duplicate paths for the steam when certain parts of the main are down for joint making, and the provision of a duplicate path often so spoils the design that joints cannot be kept tight.

SCHEDULE III.—SHOWING COAL CONSUMPTION, COST OF COAL, AND THE AMOUNT OF CAPITAL THAT CAN BE EXPENDED TO ABSORB THE ESTIMATED SAVING PER 87·6 MILLION KW.-HOURS.

Steam pressure	215 lb. per sq. in. (abs.)		365 lb. per sq. in. (abs.)		500 lb. per sq. in. (abs.
Superheat	150° F.	300° F.	150° F.	300° F.	268° F.
1. Coal consumption (lb.) per effective KW.-hr. at 100 % load factor and no station losses	1·85	1·74	1·7	1·62	1·56
2. Coal consumption (lb.) per KW.-hr. delivered to bus-bars at 50 % load factor ...	2·28	2·18	2·15	2·06	2·0
3. Annual cost (£) of coal at 10s. per ton per 87·6 million KW.-hrs. at 50 % load factor	44,575	42,500	41,900	40,350	39,075
4. Estimated saving (£) per 87·6 million KW. hrs., taking 215 lb. (abs.), 100° F. superheat as datum ...	735	2,810	3,410	4,960	6,235
5. £ capital that can be expended for annual payments to absorb amount shown in line 4. Life of plant 15 years, and compound interest at the rate of 5 %	7,650	29,300	35,500	51,600	65,000

If the piping is designed on the unit principle, *i.e.*, a number of boilers practically isolated on to one generating unit, a small equalising main only need be provided at the end of the boiler house. Ample arrangements can be made for expansion with such an arrangement, and drainage is required at two points only in each section, at the turbine steam-separator and in the equalising main. It could be arranged that steam would never enter or leave a pipe at right angles, and each branch would enter the main pipe at an angle of approximately 45 deg.

From inquiries it is apparent that the boiler mounting and valve makers are quite alive to the possibilities of high pressure and high-temperature steam coming into commercial use.

It is not so much a question of pressure in the designing of a good valve or fitting as of the temperature to which it can be subjected. Metals which are used in the manufacture of this class of material show a decrease in elastic limit when temperatures higher than 750 deg. F. are reached.

The makers of economisers are prepared to manufacture for 350-lb. boiler pressure or higher, either of their standard design, with the details modified, or of a design suitable for use as an integral part of the boiler, if necessary with horizontal and mild steel tubes.

It must be admitted that in order to attain a higher overall efficiency it is necessary to increase both the pressure and the temperature of the steam. An increase of pressure with a constant temperature would mean that the dew point was carried further up the turbine towards the high-pressure end, thus tending to accelerate blade erosion in the lower stages and a reduced stage efficiency of the turbine. Also the high-pressure blading of a turbine is considerably less efficient than the low-pressure stages, and although the losses in the high-pressure end are partly recovered in the low-pressure blades, it is apparent that to assume that a turbine for extra high pressures can be built with the same efficiency as one for a lower pressure (within limits) is taking a hopeful view, and that there is justification for hesitation before adopting extra high pressures on the part of managers responsible for the financial results of large undertakings.

The coal consumption of a station is roughly proportional to the ideal cases worked out in Schedule I; and taking a boiler pressure of 200 lb. per sq. in. by gauge as being representative practice for many power stations of moderate size, the results can be summarised as shown in Schedule 3.

The author expresses indebtedness to Mr. T. Roles, chief of the Bradford Corporation electricity department, for permission to use information gathered from the department's files, and to Mr. Abraham for his assistance in preparing the schedules.

NEW ELECTRIC PASSENGER LOCOMOTIVES.

(*Concluded from page* 46.)

A new type of electric locomotive, presenting rather unusual features, which has been placed in service on the St. Moritz-Tirano line of the Bernina Railroad in Switzerland, is described in the *Electric Railway Journal* of April 27th.

The demands made of the manufacturers, Brown, Boveri and Co., Baden, were exceptionally severe. The purchaser called for a locomotive capable of starting a 110-ton train on the most severe grades of this line, and of maintaining a speed of 11.2 M.P.H. on these grades. Moreover, the weight per axle was limited to 8.6 tons (17,200 lb.). The length of the line is 23 miles, 16¼ miles having an average grade of 7 per cent., as well as numerous curves with a minimum radius of 131 ft. Power is drawn from an overhead contact line at 750 volts, direct current. The motors on this locomotive are designed for use as generators on the down-grade trips, energising the electric track brakes and providing rheostatic braking for the locomotives. The locomotives and cars are also fitted with Hardy vacuum brakes.

It was first attempted to use two motors of 310 H.P. each for this service, but this was found undesirable, as in winter it is necessary to use this locomotive as a snow plough, and to operate it at very low speed. The original plan was therefore changed, and four motors of 155 H.P. each were substituted to provide the desired low speed with all motors in series. The maximum speed of the train on level track is 31 M.P.H.

The details of construction are shown in fig. 8. The central portion carries the track brakes, and is so arranged that it is always pulled by the leading motor truck, but is never pushed by the following truck. It carries eight magnets capable of exerting a total vertical force of 45,760 lb. This system of braking the heavy locomotive on this road has proved very satisfactory, and despite the exceptionally trying conditions during the past winter not a single accident has occurred. The motors are mounted in pairs on each truck; each motor is geared to an intermediate shaft through gears with spring-mounted rims to absorb the shocks at starting. The power is transmitted to the driving wheels by means of connecting rods. The locomotive, completely equipped with snow plough and all necessary equipment and tools, weighs 46.86 tons, of which 28.16 tons is the weight of the mechanical parts, and 18.7 tons that of the electrical equipment. In the middle of the locomotive, between the two equipment sections, is a freight compartment of 3.3 tons capacity, giving a maximum weight for traction of 50.16 tons.

In power per ton of weight this new locomotive is said to be the most remarkable of any of the narrow-gauge type built so far. Its output on an hourly rating basis is 17 H.P. per ton of weight. The gauge is 39.37 in. (1 metre).

Further details of this locomotive are given in the issue of *Schweizerische Bauzeitung* for February 23rd, 1918.

In the *Tramway and Railway World* of May 16th a description by E. Lesniewski is given of the electrified Savona-Ceva mountain section of the Italian State Railway. The railway, which may be regarded as a standard of the Italian electric railways, is noteworthy owing to the technical perfection of its equipment, to which particular attention has been given, as well as to the solidity of construction, owing to its economic and strategic importance. The equipment presents many novel and interesting features, new methods of train conduction, only possible under the system of traction here adopted, having been utilised with great success.

The whole of the electrified section, having a length of some 45 kilometres, has a single track, and comprises numerous tunnels, and curves to the extent of about 60 per cent. of its total length. The least curve radius is 400 metres, and the maximum gradient 2.5 per cent. The track traverses several mountain ranges, attaining an elevation of 1,600 ft. above sea level. Between Savona and Ferrania is a very difficult section, where in a distance of 10 miles the altitude of the track shows a variation of over 1,000 ft. The tunnel in which this section terminates, 1¼ miles in length and located on a curve, hindered the traffic considerably when it was under steam traction.

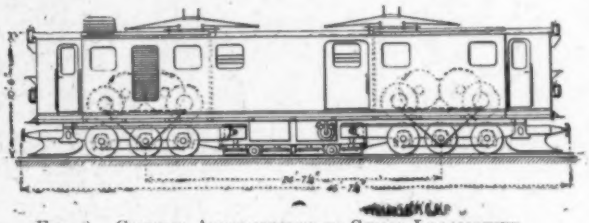

Fig. 8.—General Arrangement of Swiss Locomotive.

The necessity of coping with ever-increasing goods traffic, coupled with the desire to accelerate the speed, led to the electrification of the section. This was completed in the spring of 1914, since which time the whole of the goods and passenger traffic has been successfully dealt with by electric traction. The three-phase system was selected for this line, with a voltage of 3,700 on the trolley line, and a frequency of 16.7 periods per second. The capacity of the line was considerably augmented after electrification, while the tunnel referred to above ceased acting as a "bottle neck," and even without forced ventilation there was no essential difference between the traffic conditions in the tunnels and on the open parts of the line. The all-round speed compared with that of the former steam traction has been accelerated to about double, the speed maintained on the steepest up-grade being 31 miles per hour, whereas specially powerful mountain steam locomotives of the "decapod" type were unable to exceed a speed of 15 miles per hour. A further acceleration of speed for express trains is projected, for which purpose high-speed Westinghouse locomotives (type 1—3—1), rated at 2,600 H.P., are being built, capable of hauling trains on up and down grades (2.5 per cent.) at a speed of 47 miles per hour.

The three-phase locomotive used on the Savona-Ceva line combines great mechanical and electrical strength, and a capacity to stand heavy overloads. The locomotive has an amply high centre of gravity, and in consequence of the method of motor suspension, the deadweight on the axles—*i.e.*, the weight not carried by springs—is reduced to a minimum, consisting only of the weight of the axle and part of the weight of the driving rods. The locomotive's weight per one H.P. (ratio weight to H.P.) of its rating is less than in other types of locomotives, as it develops about 36 H.P. per metric ton of its weight, and consequently its power per ton of its weight is 2-3 times as much as the majority of single-phase or high-tension D.C. locomotives.

The total weight of the locomotive is 60 metric tons, evenly distributed over the five axles. The principal dimensions and weight of the locomotive are:—

Weight	**60 metric tons.**
One-hour rating	**2,200 H.P.**
Tractive effort corresponding to one-hour rating	**12 metric tons (26,000 lb.)**
Speed at this tractive effort ...	**31 miles per hour.**
Length over buffers	**9,520 mm. (31 ft. 6 in.)**
Total wheel base	**6,120 mm.; (20 ft. 6 in.)**

The two motors of the locomotive drive the wheel through a so-called "Scotch yoke" system of gearless drive. The motors are fed directly from contact trolley line with a three-phase current at 3,700 volts. Two phases of current are supplied by two-phase contact line, the third by the rails. The locomotive has two operating speeds, 31 and 15.5 miles per hour. The higher speed is obtained with both motors connected to the line with short-circuited winding of the rotor. The lower speed is obtained by putting the motors in cascade; the stator winding of one of the motors is then connected direct to the line, and that of the second is fed from the rotor winding of the first motor.

The use of regeneration on this line has considerably reduced the energy consumption; but of not less importance is the greater degree of safety assured and the smoothness of running on the down grade, as well as the reduction in wear of the track, rolling stock, tires, and of the braking system.

The Swiss Federal Railways have recently ordered a number

of electric locomotives for use on their St. Gothard line. The principal features of the new locomotives are described in the issue of *Le Génie Civil* for June 15th, and the particulars that follow are taken from that journal :—

The electrical part of the light-type locomotive for express train service is being constructed by the Oerlikon Co., and the mechanical part by the Swiss Locomotive Manufacturing Co., of Winterthur. The overall length of this locomotive is 13.5 metres, and it has three coupled live axles. The two motors are of the single-phase type with series compensated commutators, having 12 poles and displaced auxiliary field, developing 825 H.P. each. They are coupled together, fixed to the frame at the centre of the locomotive, and transmit their power through a symmetrical gear system, ratio 1 : 2.84, to the two intermediate axles, which drive the central live axle by a triangular system of levers and links, and the other live axles by a common coupling rod.

Reversers (with electro-pneumatic drive) and braking gear are placed above the motors. At each side of the motors are placed the transformers, and above these the speed-stage controllers, principal switches, compressors, &c. The normal driving force is 8,900 kg., the maximum tractive force 13,500 kg., and the maximum peripheral power 1,650 kg. The normal speed is 50 kilometres per hour, while a maximum speed of 75 km. per hour can be developed. Total weight, including brake gear, 90 tons (metric).

The heavy-type express locomotive constructed by the firm before-mentioned is of the bogie type; total weight, 106 tons; wheel-base, 16.2 metres. It has two six-pole motors each developing a peripheral horse-power of 560. The arrangement of the motors, &c., is similar to the preceding type. The locomotive body rests on the trucks, and contains at its centre the oil transformer with speed-stage controllers and fan. The converter and compressor groups are fitted at the two ends of the body, and have protecting bonnets.

The construction has been simplified by the use of a single transformer, but the weight of the frame is very great. Normal tractive force, 18,000 kg.; normal peripheral efficiency, 2,250 H.P. for a normal speed of 50 km. per hour, and a maximum speed of 75 km.

Both the above types have 23 speed-control stages, and are also fitted with the multiple-unit system of drive, which allows of the coupling up of a number of locomotives on a gradient which are under the control of one driver.

In the new Oerlikon locomotives the two bogies are direct coupled to each other. The outside two-thirds of the truck contain the motors and control apparatus, which are covered by low bonnets. The body proper is only one-third of the total length of the locomotive. The two controllers, each of the 12-contact type, are mounted close to the transformers. At the two ends of the body are the driving cabs mounted with their pantographs on top. The main switch and transformer covers form part of the body roof, thus reducing to a minimum the number of H.T. conductor inlets, and dispensing with a special H.T. cab inside the motor group. The pivots are easily accessible, and the few flexible cables in their vicinity which lead to the motors can easily be led to the trucks. The driver is very near to the main switch, so as to be able to operate it mechanically if it is desired for any reason to dispense with the multiple drive.

The normal power of the four motors is 2,100 H.P. (peripheral). Weight of electrical part, 58 tons, and of the mechanical part 71 tons. Total length, 19.2 metres.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

10,789. "Limit switches for opening electrical power circuits." H. Morris, Ltd., G. A. Robertson & G. Smith. July 2nd.

10,791. "Electrical generators and electric motors." J. Shepherd. July 2nd.

10,795. "Electro-magnetic separators." A. Davies. July 2nd.

10,799. "Liquid electrical resistances." G. Dearle. July 2nd.

10,806. "Flywheel magneto devices for internal-combustion engines." F. H. Farrer & G. Funck. July 2nd.

10,809. "Spark plugs." W. S. Thomas. July 2nd. (U.S.A., June 29th, 1917.)

10,816. "Use of audion lamp relay or amplifying apparatus in telephony." M. Latour. July 2nd. (France, June 22nd, 1917.)

10,830. "Telephones." Siemens & Halske Akt. Ges. July 2nd. (Germany, July 1st, 1917.)

10,857. "Control of electrically-propelled trucks, &c." P. A. H. Mossay and Mossay & Co. July 2nd.

10,858. "Electrically-propelled trucks." P. A. H. Mossay & Mossay and Co. July 2nd.

10,859. "Electrically-propelled vehicles." P. A. H. Mossay & Mossay and Co. July 2nd.

10,864. "Regulating device for dynamo-electric machines." R. Bosch Akt. Ges. (R. & O. Imray). July 2nd.

10,877. "Electric batteries." S. L. Price. July 2nd.

10,925. "Electric ignition apparatus." F. L. Hollister. July 3rd.

10,933. "Automatic switches." Western Electric Co. (Western Electric Co., U.S.A.) July 3rd.

10,945. "Electric switchgear apparatus." E. S. Conradi. July 3rd.

10,962. "Electric cranes and hoisting appliances." H. Simon, Ltd., & H. Williams. July 4th.

10,997. "Treatment of metals and refractory materials, and of tools or crucibles made thereof, and in electric furnaces used therefor." G. Marsh. July 4th.

11,013. "Automatic regulator for dynamo-electric machines." R. Bosch Akt. Ges. & O. Imray. July 4th.

11,042. "Electrical instruments and appliances for transmission and reproduction of sound." D. F. McQuire & F. W. McQuire. July 5th.

11,043. "Electrical fuses." R. A. R. Bolton. July 5th.

11,045. "Automatic telephone exchange systems." Western Electric Co. (Western Electric Co., U.S.A.) July 5th.

11,048. "Undulating and controlling electric currents passed through the body for medical purposes." E. E. Greville. July 5th.

11,067. "Electric apparatus for lengthening and extinguishing gas burners." P. Hayes. July 5th.

11,084. "Spark plugs." R. Champlin, R. J. Cook & H. A. Todd. July 5th.

11,110. "Electric conductor connections, and rendering same impervious to fluids." R. B. Moon. July 6th.

11,113. "Electrical apparatus." R. B. Moon. July 6th.

11,125. "Electrical torpedo nets." A. Hedina. July 6th. (U.S.A., March 6th.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

936. Process for the production of copper tubes. S. O. Coles. March 6th, 1918. (116,509.)

1,609. Liquid resistances, particularly for use in the rotor circuits of induction motors when used for ship propulsion and the like. Brush Electrical Engineering Co. & C. C. Sutton. August 1st, 1917. (116,510.)

4,923. Method of and apparatus for use in electric welding, brazing, and like operations. F. B. Dehn (Electrical Railway Improvement Co., U.S.A.). April 5th, 1917. (116,513.)

6,525. Electrical connections for cables, wires, switches, lampholders, plugs, connectors, and the like. R. Reynolds. May 8th, 1917. (116,515.)

7,953. Electrical measuring instruments. G. A. Cheetham. June 2nd, 1917. (116,524.)

8,232. Radiotelegraphy and radiotelephony. J. Bethenod. May 26th, 1916. (107,581.)

8,343. Electric insulating material. A. R. Muller. June 11th, 1917. (116,532.)

8,933. Dynamo-electric machines. British Thomson-Houston Co. & A. A. Pollock. June 21st, 1917. (116,556.)

8,945. Rotary transformers or converters. J. G. Shaw, C. R. Shaw and H. G. Sharp. June 21st, 1917. (116,557.)

9,350. Dynamo-electric machines. J. W. Burleigh. June 29th, 1917. (116,571.)

9,501. Sparking plugs for internal-combustion engines and the method of manufacture. R. Howarth. July 3rd, 1917. (116,573.)

9,675. Dynamo-electric machines. Vickers, Ltd., & H. F. Brown. July 4th, 1917. (116,577.)

10,794. Method of magnetising cores and apparatus therefor. Automatic Telephone Manufacturing Co. & P. N. Roseby. July 27th, 1917. (116,587.)

11,249. Make-and-break devices. F. B. Dehn (Pittsfield Spark Coil Co., U.S.A.). August 3rd, 1917. (116,600.)

13,369. Sparking plugs for internal-combustion or explosion motors. G. A. Pariani. September 18th, 1917. (116,623.)

14,175. Treadles for electric switches used in railway signalling. S. T. Dutton & T. A. White. October 1st, 1917. (116,629.)

17,277. Rotary rectifier of alternating current. A. D. Macropoulos (C. D. Macropoulos). November 23rd, 1917. (116,646.)

18,042. Electric interrupters. Soc. d'Electricité Nilmelior. January 19th, 1917. (112,931.)

19,065. Manufacture of carbon electrodes. C. H. Thompson. December 24th, 1917. (116,661.)

Notes from Spain.—Our Special Correspondent in Spain sends the following :—

Railway Electrification.—After a three days' debate the Spanish Parliament has passed the Bill for the electrification of some 70 km. on the railway of the Compania del Norte, at a point near Puerto Pajares, where the Cantabrian mountains are crossed. The debate brought out some interesting facts, though a good deal of the discussion centred round the advantages and disadvantages of railway nationalisation.

The object of electrification at Puerto Pajares is to assist in the distribution of Asturian coal throughout Spain, and the promoters of the Bill declare that by electrifying the mountainous portion of the line it would be possible to transport 12,000 tons of coal daily past that point. The project will cost 40,000,000 pesetas (£1,600,000 at the pre-war rate of exchange), and some of the speakers advocated a delay until the end of the war, on account of the present high cost of electrical material. Another reason for delay was that after the war foreign coal would be available once more. The supporters of the Bill argued that Spain must develop her own resources, even though she must buy electrical plant from Switzerland to do so, and they showed that the present backwardness in the means of transport was a fatal hindrance to national progress.

It is interesting to note that in this instance hydro-electric energy will be used to develop the transport of coal.

Prof. Sánchez Cuervo has been appointed representative of the Government during the electrification. The Compania del Norte has not yet appointed its engineer.

Projected Hydro-electric Plant.—The civil authorities at Soria have been asked to concede the use of several waterfalls on the River Duero and its tributaries situated in the district of Duruelo. Senor C. Aynso has applied for the use of 1,000 litres of water per second in normal times, reduced to 200 litres in times of low water, at a useful head of 358 metres, the resultant energy being destined to supply electric light in Duruelo and power for a proposed light railway. A canal 1,500 metres long has to be constructed. This does not present any great difficulty, and the fact that all the work will take place on State land is expected to result in a smaller capital outlay.